OCTOBER, 1951

HEATING AND VENTILATING

INCLUDING AIR CONDITIONING – PIPING – REFRIGERATION – AIR SANITATION

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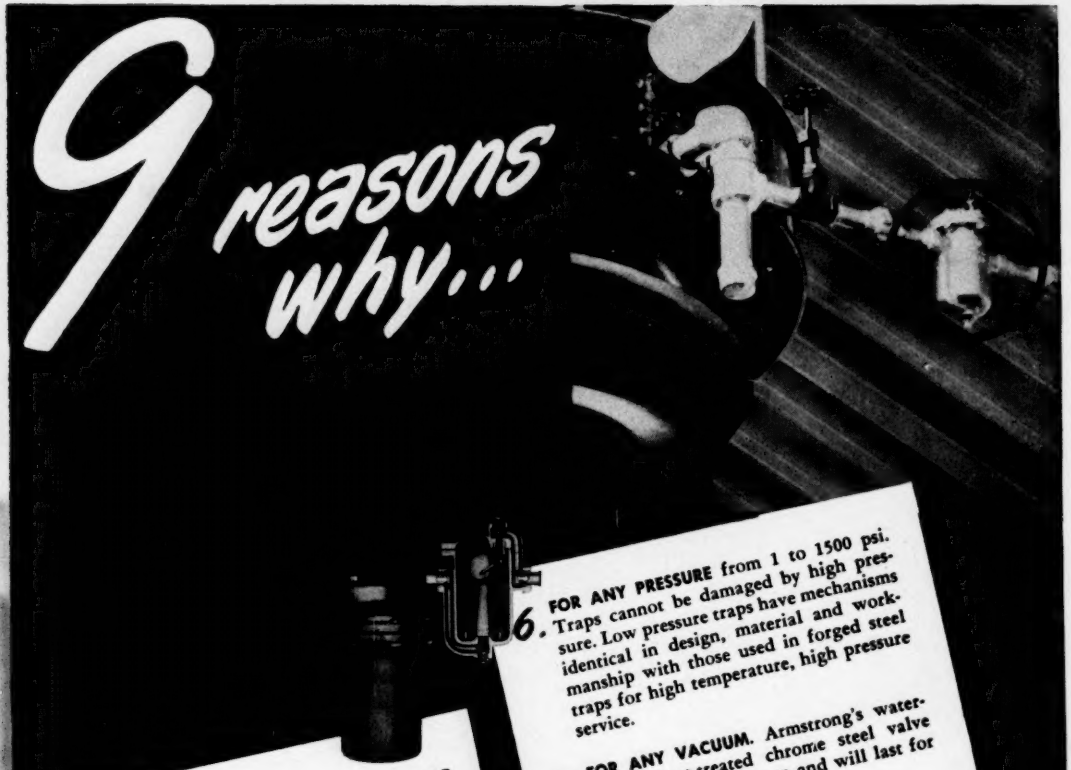
9 reasons why...



1. **MORE ACTUAL CAPACITY PER DOLLAR** due to Armstrong's unique free floating lever mechanism.

2. **NO GAMBLE IN SELECTING TRAPS** because Armstrong capacity ratings are actual trap tests with hot condensate instead of slide rule calculations, cold water, or orifice tests.

3. **MINIMUM INSTALLATION COST.** Choice of horizontal or vertical traps reduces fittings and installation labor.

4. **BIG AIR VENTING CAPACITY.** Armstrong Traps are non airbinding. For quick heating use Armstrong BLAST Traps. Auxiliary air reliefs seldom needed.

5. **STRAINERS SELDOM REQUIRED.** Ordinary sediment and sludge are discharged along with condensate. You can guarantee 99 out of 100 Armstrong Trap installations without strainers.

6. **FOR ANY PRESSURE** from 1 to 1500 psi. Traps cannot be damaged by high pressure. Low pressure traps have mechanisms identical in design, material and workmanship with those used in forged steel traps for high temperature, high pressure service.

7. **FOR ANY VACUUM.** Armstrong's water-sealed, heat-treated chrome steel valve parts do not leak steam and will last for years.

8. **ELIMINATE CALL BACKS.** Very seldom does an Armstrong Trap require servicing by the contractor. No adjustments, and no close clearances to require breaking in.

9. **UNQUALIFIED GUARANTEE.** Not for one year, not for two years, but for life are Armstrong Traps guaranteed against defects in workmanship or material.

SEE OUR CATALOG IN SWEET'S

TWO VALUABLE HANDBOOKS

1. The Steam Trap Book — 36 pages of data on selection, installation and maintenance of Armstrong Steam Traps for ALL services.

2. "How To Select Steam Traps for Draining Unit Heaters" — 8 pages of data including BTU capacities of unit heaters made by 24 different manufacturers, how to select traps for each, conversion tables, installation diagrams and other information not available from ANY other single source. Anyone is welcome to a copy of both books. A post card request will do.

ARMSTRONG MACHINE WORKS, 846 Maple St., Three Rivers, Mich.

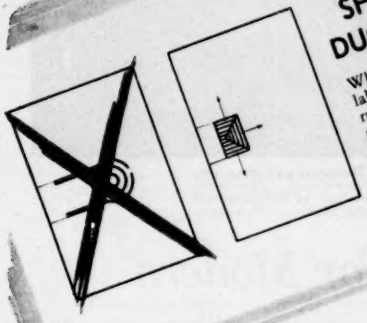
ARMSTRONG STEAM TRAPS

Over a Million in Use... For Power... Process... Heating

How to Save Metal and Cut Costs . . .

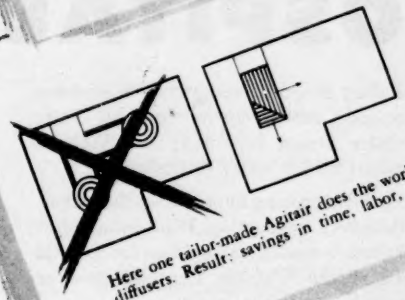
Specify AGITAIR®

SOUARE & RECTANGULAR AIR DIFFUSERS



SHORTER DUCT RUNS

Why waste metal and labor in the long duct runs? Check the diagrams and note the savings that result when tailor-made Agitair diffusers are employed.



FEWER OUTLETS

Here one tailor-made Agitair does the work of two ordinary diffusers. Result: savings in time, labor, metal and money.

CONSERVE CRITICAL MATERIAL

Tailor-made Agitair diffusers mean greater all-around savings with no loss in efficiency.

Today, more and more specifications call for AGITAIR Type R. It's the only diffuser that offers such savings in metal and money . . . without reducing efficiency. That's because it's the only diffuser that may be assembled in a variety of patterns to provide blows in one - two - three and four directions with discharge orifices proportional to the area being served. Remember AGITAIR is the only air diffuser tailor-made for each application.

Write for Complete Data

Air Devices Inc.

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Air Diffusers
Air Filters • Exhausters

East Tennessee Tuberculosis Hospital, Knoxville, Tenn. Architects and Engineers: Baumann and Baumann; Will W. Griffin and Shi G. Goodwyne, Associates. Heating Contractors: John F. Humphrey Company, Knoxville. Medical Consultants: Dr. R. H. Hutcheson, Commissioner of Public Health and Secretary of the Tennessee TB Commission, and Dr. W. W. Hubbard, Director of Hospital Service for the State of Tennessee.

Four-Zone Steam Heating For Modern

180-BED TB HOSPITAL

Heating specifications for the new East Tennessee TB Hospital stated: *"There shall be continuous flow of steam to the system with full or fractional heating of radiators at all times when heat is on".*

A 4-zone Webster Moderator System of Steam Heating meets this specification, supplying steam according to need for nursing floors, service and treatment units, operating rooms and laboratories.

The new Hospital is an important unit in the Tennessee plan, conceived by Governor Browning in 1937, to coordinate new and existing state-owned tuberculosis hospitals.

In addition to supplying 180 additional beds, the new building provides for surgical and laboratory work for all TB institutions in the area north of Knoxville.

Other Webster heating products used include Type "WI" Radiation; Webster Radiator and Drip Traps throughout, three Webster-Nesbitt Unit Heaters with Series 45 Unit Heater Controls; Webster '78' Process Steam Traps for medium and high pressure service, including laundry equipment; a Webster Oil Separator and Grease Trap for the Feed Water Heater; Webster Steam Separator, and Webster Vacuum Breakers for hot water generators.

The new Hospital is proving in operation the soundness of the designers' conception. Want some information on Webster's money saving ideas for hospital heating? Call in the Webster Representative or write us.

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In Canada, Darling Brothers, Limited, Montreal

WEBSTER
MODERATOR
SYSTEM
OF STEAM HEATING
"Controlled by the weather"

HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS

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Editorial Staff

Editor
CLIFFORD STROCK

Associate Editors
NATHAN N. WOLPERT
WILLIAM B. FOXHALL

Technical Consultant
T. W. Reynolds

Advertising Staff

Chicago
GEORGE G. TURNER
228 North La Salle Street.

New York
HARRY J. TWINE
148 Lafayette Street.

Cleveland
EDWARD B. McENTEE
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Los Angeles
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ROBERT B. LUCHARS

Vice-President and Treasurer
EDGAR A. BECKER

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The Contents of HEATING AND VENTILATING are indexed monthly by Industrial Arts Index and by Engineering Index

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Also Publishers of
HEATING & PLUMBING EQUIPMENT NEWS
and technical books.

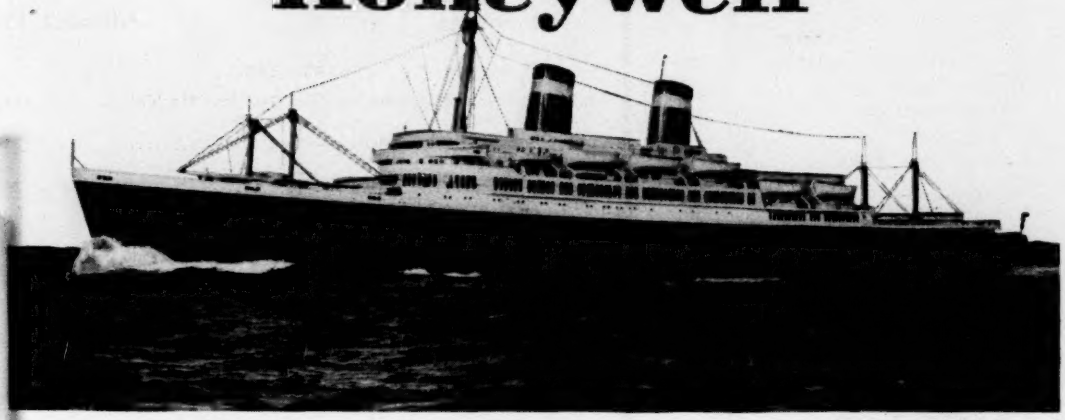
THIS MONTH'S COVER

Service hoists in Flatbush, N. Y., bus garage, with tail-pipe connections for fume removal. Precautions against carbon monoxide are described beginning page 99.

Do you know how ships help you have better temperature controls ashore?
Why do "Coordinated Classrooms" make students learn faster?
How does temperature control help give babies a better start in life? Read about it in . . .

Your Progress Report from

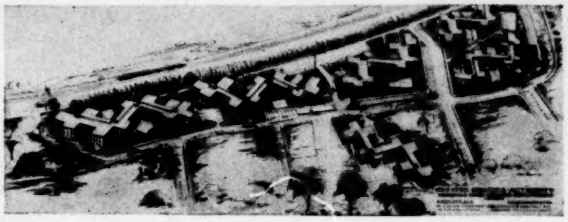
MINNEAPOLIS
Honeywell



U. S. S. Independence

New U. S. Liners "Test" Controls at Sea

The toughest use-test temperature controls have to face is found aboard ship. Here controls must give a sensitive, accurate performance in the face of vibration, shock and corrosive salt-air conditions. Experience gained in making sea-going controls expands the knowledge of Honeywell engineers, helps them design controls that give a better, more satisfying performance on land. The wide range of control applications ashore that benefit from sea-testing is demonstrated by the many types of controls used aboard American Export Lines' fabulous new sister ships "Independence" and "Constitution." Honeywell thermostats on the liners provide individually controlled comfort in every stateroom. And throughout the ships—in lounges, cargo holds, engine rooms—there are hundreds of other automatic controls. All of these long-lasting controls for heating, ventilating, air conditioning and refrigeration are built by Honeywell.



Personalized Heat Control for 336 Apartment-Dwelling Families in Boston

In the Boston Housing Authority's Archdale Road Project, now nearing completion, three boilers will serve the six buildings. But each of the 336 tenants will be able to enjoy the room temperatures he likes best—just as he would in the finest private home. For, in the Archdale project, there will be a Honeywell thermostat on every living room wall. This is Personalized Heat Control—the only temperature control system that permits a landlord to keep *all* his tenants comfortable at the same time. And it actually *saves* him fuel, because he never has to overheat a building to satisfy the few who demand higher-than-average temperatures.

Architect: M. A. Dyer & Co., Boston; Engineers: Hayden, Harding & Buchanan, Boston; Heating Contractor: T. G. Gallagher, Somerville, Mass.; General Contractors: Jefferson Construction Co., Cambridge.

Massachusetts Hospital has Air Conditioned Nurseries, Individually Controlled Room Temperatures

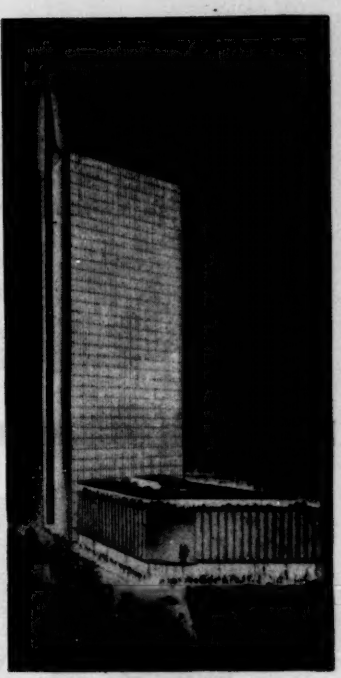
Most medical authorities agree that rigidly controlled room temperatures are needed to give new babies maximum protection. That's why Lowell General Hospital will have Honeywell temperature and humidity controls in the nurseries, labor, delivery and operating rooms of the new maternity and pediatric building. Moreover, to help bring mothers back to normal faster, each bedroom will have Honeywell Individual Room Temperature Control—the only practical way to compensate for effects of wind, sun, open windows and variations in occupancy in hospitals.

Architects: James H. Ritchie & Associates, Boston; General Contractor: Daniel Cunningham Construction Co., Inc., Boston; Mechanical Engineers: C. E. Doucette, Boston; Mechanical Contractor: J. J. Hurley Co., Boston.

40 Stories of Comfort in Southwest's Largest Building

When the Republic National Bank's impressive new home is completed in Dallas sometime next year, every room will have the wonderful kind of comfort offered by Honeywell Individual Room Temperature Control. This system compensates better than any other for effects of wind, sun, temperature and variations in internal load. It makes sure occupants always receive exactly the right amount of warm or cool air needed for comfort—no matter what the Dallas weather. Room thermostats in the new bank will be pneumatic. And, of course, all other controls needed for year-round air conditioning will be supplied by Honeywell. Instruments will be furnished by Honeywell's Industrial Division.

Architects: Harrison & Abramovitz, New York; Assoc. Architects: Gill & Harrell, Dallas; Consulting Engineers: Jaros, Baum and Bolles, New York; Assoc. Consulting Engineers: Zumwalt & Vinther, Dallas; General Contractors: J. W. Bateson Co., Inc., Dallas; Mechanical Contractors: The Farwell Co., Inc , Dallas.



New Jersey Classrooms "Coordinated" for Faster Learning

What determines how fast a child learns? Inborn capacity, of course. *And* classroom conditions—according to recent large-scale experiments. These tests showed that in "Coordinated Classrooms"—rooms where seating, lighting, noise level, heating and ventilating are properly controlled—students of all I. Q. levels make greatly improved progress. Shown above is a new Cedar Grove, N. J., elementary school, all nine rooms of which will be "coordinated." To keep room temperatures uniform and air properly fresh, Cedar Grove officials chose simple, accurate Honeywell controls.

Architect: Alfonso Alvarez, Jr., Upper Montclair, N. J.; Engineers: Vogelbach and Baumann, Jersey City, N. J.; Heating Contractor: Albert F. Ruehl Co., Newark, N. J.

For additional information on any of the installations, products or systems mentioned in this report, call your local Honeywell office. Or fill in the coupon below and mail it to us *today*.

Minneapolis-Honeywell
Dept. HV-10-192, Minneapolis 8, Minn.

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- ☐ Marine controls
- ☐ PHC for apartments
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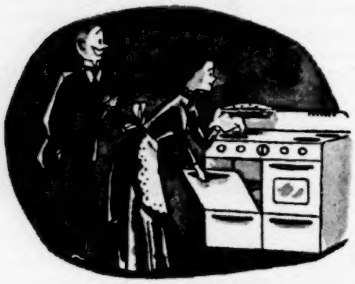
MINNEAPOLIS
Honeywell

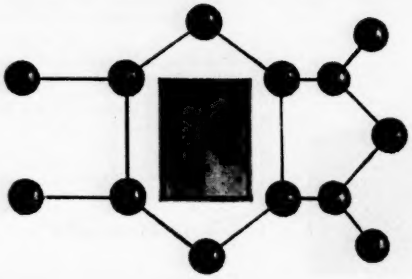
First in Controls

Everybody who sells heating equipment should

People need a new kind of home. They need it because their way of living has changed ...but their houses (bound by convention) haven't. They're still pretty much the same as in Grandpa's day. They have new gadgets, new appliances. And, of course, central heating. But generally speaking, people today don't sleep any better, eat any better, or have less dirt in their houses than Grandma and Grandpa did in theirs.



They're living in Model T's. On the highway or on the job, most people are strictly 1951. But when they come home, they put on a theoretical celluloid collar. And their wives wear theoretical bustles as they swelter over their modern ranges in much the same way Grandma sweltered over her coal stove. Yes, the homes people live in shape their lives.

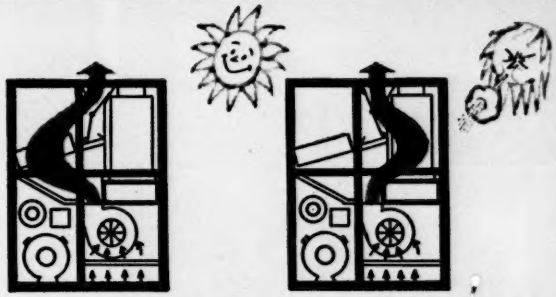


Today they need a "Comfort System." Central heating has changed houses somewhat. But, after all, it's a one-season proposition. On the other hand, the new Carrier "Comfort System" keeps you comfortable all year round. It's the new Carrier Weathermaker* Air Conditioner. Here's a single package you can sell that heats, cools, dehumidifies and circulates clean, filtered air.

Built around air conditioning. That's the idea of the Weathermaker Home. Free of climate and location restrictions, the Weathermaker Home can be designed and built as you want. When you sell the Carrier Weathermaker for such a home, you are selling a new way of living. And we're going to help you sell it.

read about the Carrier Weathermaker Home

First, we'll give you the facts on the equipment itself – the Carrier Weathermaker Air Conditioner. We'll tell you why it's far and away the finest year-round home comfort system available. We'll put the finest air conditioning background in the business at your disposal. And we're taking this story right to *your* customers, in a dozen national publications. So get the full story yourself...mail the coupon *today*.



Alternate air travel for heating and cooling is just one Carrier exclusive in the great new Weathermaker. It delivers the necessary *extra* air for cooling, and wastes no fan power. Other exclusives: high dehumidification; choice of return air and flue connections; burner and control assembly slides out for easy servicing; entire unit serviceable from one side.

Fits anywhere. Basement, attic, closet, utility room. Only 43" deep, 52" wide, 70" high. Ships in sections to go through 30" doorways easily. Capacities: 3 hp. or 5 hp. of cooling with 100,000 to 140,000 Btu's of heating, and 5 hp. of cooling with 150,000 to 190,000 Btu's of heating. For all types of gas. Available in 220 volt, single or 3 phase, 60 cycle current. And the new Carrier Weathermaker Air Conditioner can be used in many types of *commercial buildings*. That's another part of the Weathermaker story we're anxious to send you. Write for it today. **Reg. U. S. Pat. Off.*

Carrier

AIR CONDITIONING • HEATING • REFRIGERATION

Carrier Corporation, 308 South Geddes Street, Syracuse 1, New York

Send me the whole story on the new Carrier Weathermaker Home.

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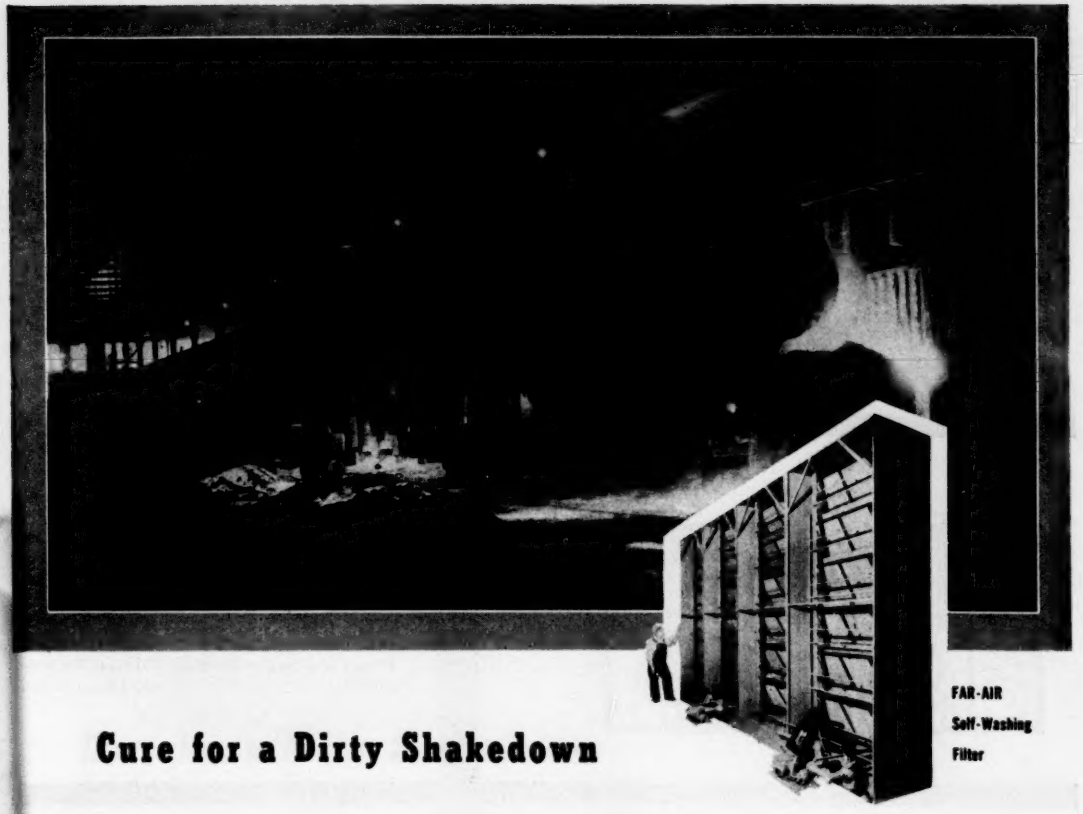


FAR-AIR Self-Washing Filter

Cure for a Dirty Shakedown

Twice each day it was necessary for a large Eastern steel producer* to shakedown his furnaces. This caused high concentrations of dirt which resulted in severe air filter maintenance and inefficient air conditioning.

FARR Company, when called upon for a permanent solution, recommended a FAR-AIR** Self-Washing Filter. This proposal was approved and an installation made. After two years of use, the results are very satisfactory; the dirt problem is solved and another unit has been installed in the same plant.

The reason for the success of the FAR-AIR Self-Washing unit in this case (in addition to the extremely high efficiency of the FAR-AIR filters) was the fact that the unit could be set to *automatically* wash and re-oil itself just prior to the time that the furnaces were shaken down. Thus, maintenance was virtually eliminated and the filters were always at peak efficiency.

FAR-AIR Self-Washing Filters can be furnished to handle any CFM requirement. If you have an air filtration problem, Farr engineers will be glad to help you find the proper solution. There is a FAR-AIR product to meet most filtering needs. Write for complete information to Farr Company, P.O. Box 10187 Airport Station, Los Angeles 45, California.

Other FAR-AIR products include standard commercial and industrial panel filters, marine filters, rotary coolers, grease eliminators, filter maintenance equipment. Also, special filters for special applications.

*Name furnished on request.

**Trade Mark Registered

FAR-AIR FILTERS

"Better by Farr"

FARR COMPANY *Manufacturing Engineers*

Los Angeles · Chicago · New York

M'f'd under license by Control Equipment Co., Ltd., Montreal, Canada

ANOTHER PROMINENT BUILDING

"Buffalo"

• The Washington Post
BUILDING • WASHINGTON, D. C.

Washington Post Building. Engineer: Albert Kahn, Associated Architects and Engineers, Inc. Contractor: John McShain, Inc. Mechanical Contractor: Standard Engineering Co.

Clean, fresh air at right temperature and right humidity went into the planning of this famous and ultra-modern newspaper building. Why? Because proper air control in a building directly affects the efficiency, morale and well-being of those working inside. This has been proven time and time again in factory, office building, store and, in fact, any place where people congregate. And "Buffalo" Fans, Pumps and Air Conditioning Units have been doing their jobs to such satisfaction that they have become a standard to many of the leaders in the construction and engineering fields. You are safe in recommending "Buffalo", the name you see in big installations throughout the world.

Above, a large "Buffalo" Air Washer supplying clean, properly tempered air at all times in the Washington Post Building. At left are two of the large "Buffalo" Limit-Load Fans keeping air circulating throughout the building.

AIR—Vital to Defense

Thousands of "Buffalo" Fans, Pumps and Air Conditioning Units are today rendering valuable service in every essential industry, from aircraft to textiles, in mines and on shipboard —helping the worker, bettering the product, operating 24 hours a day with little attention. Full details on any unit on request.

Above right, two other "Buffalo" Fans ventilating the 7-story building: left, a small Belted Vent Set, and right, two medium sized Limit-Load Fans.

"Buffalo" FIRST FOR FANS

BUFFALO FORGE COMPANY

480 BROADWAY BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Branch offices in all Principal Cities

VENTILATING FORCED DRAFT | AIR WASHING COOLING | AIR TEMPERING HEATING | INDUCED DRAFT EXHAUSTING PRESSURE BLOWING

31,756 radiator traps and valves as shown below will control the steam to radiators and convectors. Other Sarco specialties include 605 float-thermostatic traps with strainers for risers and main drips.

BREUKELEN HOUSES
BROOKLYN, N. Y.
Alga Engineering Corp., Heating Contractors, Brooklyn, N. Y.; William I. Hohauser, Architect & Engineer, New York City; Sullivan A. S. Paterson, Consulting Engineers, New York City.

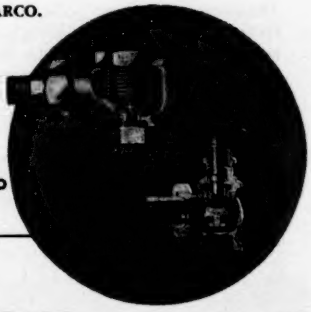
SARCO heating specialties to be used in

3 NEW YORK CITY HOUSING PROJECTS

Seventy-two apartment buildings to house 4,074 families are being equipped with SARCO HEATING SPECIALTIES to insure trouble-free operation.

Two of the three projects are illustrated above. The third is James A. Bland Houses, Flushing, for which the architects are Chapman, Evans and Delehanty of N. Y. C. Syska and Hennessy, Inc. of N. Y. C. are the consulting engineers. H. Sand & Company, Inc., also of N. Y. C., are the heating and ventilating contractors.

For dependable, efficient service over the years, specify SARCO. Write for new Catalog 202, on the complete line.



SARCO Radiator Trap Type H

SARCO

SARCO COMPANY, INC.

EMPIRE STATE BUILDING, NEW YORK 1, N.Y.

SARCO CANADA LTD., TORONTO 5, ONTARIO

REPRESENTED IN PRINCIPAL CITIES

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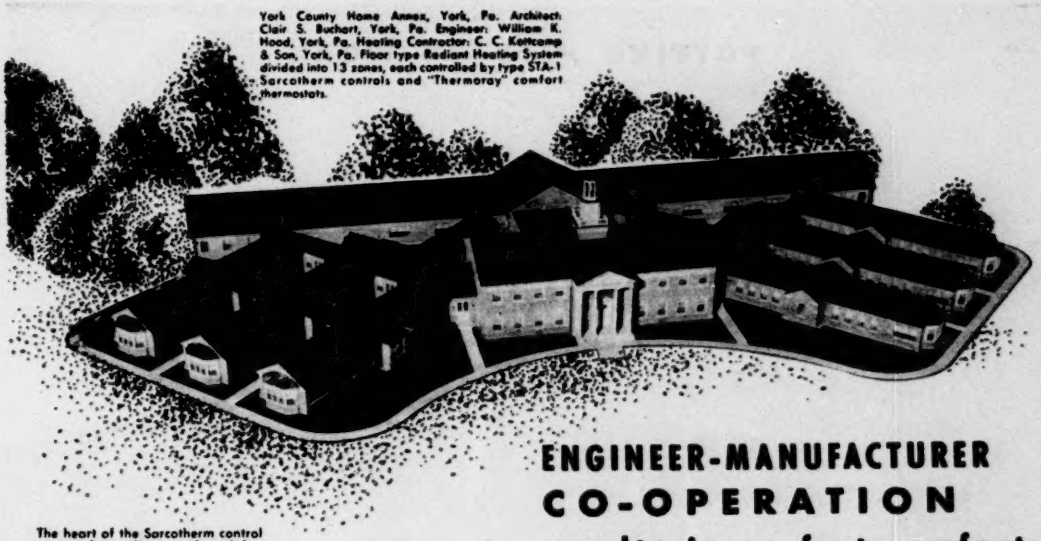


York County Home Annex, York, Pa. Architect: Clair S. Buchart, York, Pa. Engineer: William K. Hood, York, Pa. Heating Contractor: C. C. Kottcamp & Son, York, Pa. Floor type Radiant Heating System divided into 13 zones, each controlled by type STA-1 Sarcotherm controls and "Thermoray" comfort thermostats.

ENGINEER-MANUFACTURER CO-OPERATION

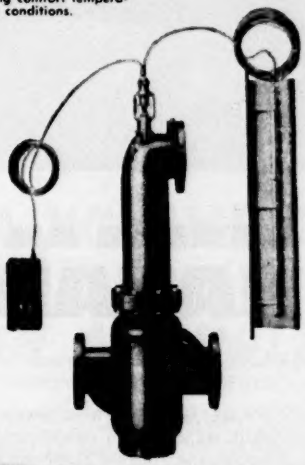
results in perfect comfort

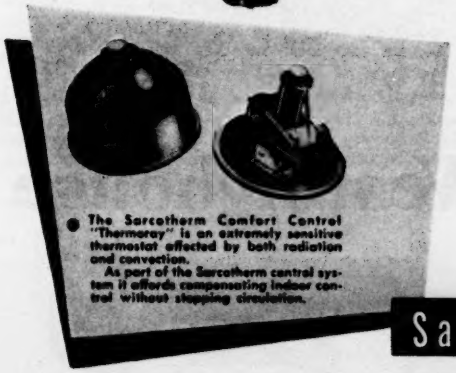
WITH

Sarcotherm

RADIANT HEAT CONTROL

The heart of the Sarcotherm control system for radiant or forced hot water heating is this unique control valve. It is actuated by liquid expansion thermostats, one located outside the building and one in the valve itself. Between them they anticipate changes in heat loss ratio, thus maintaining comfort temperatures under all conditions.





● The Sarcotherm Comfort Control "Thermoray" is an extremely sensitive thermostat affected by both radiation and convection.

As part of the Sarcotherm control system it affords compensating indoor control without stopping circulation.

● Here is a striking example of the advantages of close cooperation between the architect's designing engineer and an equipment manufacturer who not only offers complete weather compensated control systems for hot water and radiant heating, but can supplement this with 30 years' experience and the most complete line of accessories for all types of heating.

In the case of York County Home Annex illustrated, engineer William K. Hood, York, Pa., designed a radiant heating system divided into 13 zones, each individually controlled by Sarcotherm.

An important feature of the control system is the unique "Thermoray," a very sensitive heat loss thermostat, influenced by both radiation and convection.

Sarcotherm also regulates supplementary baseboard heating, and unit heaters.

Sarcotherm engineers are eager to work closely with architects, consulting engineers and contractors to develop the best control hook-up and assure its correct installation.

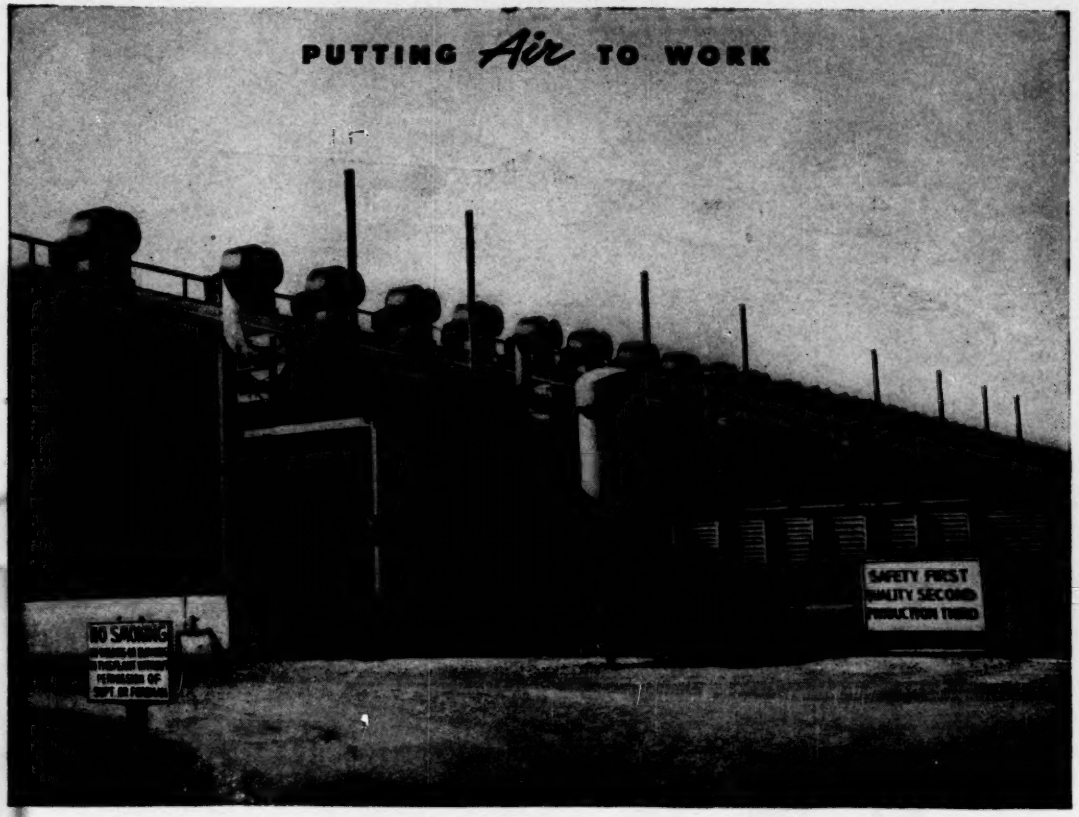
Send us your next problem—there is no obligation. Or write for complete catalogue.

22

Sarcotherm CONTROLS, INC.

EMPIRE STATE BUILDING · NEW YORK 1, N. Y.

A SARCO PRODUCT



28 LUNGS THAT EXHALE AN EXPLOSIVE HAZARD

Every 60 seconds there must be a complete change of air in this building. Reason: to prevent the accumulation of explosive hydrogen, used in manufacturing ammonia. But what could be a dangerous process is made safe in one of the newest synthetic ammonia plants recently built in the Southwest by exhausting air through Sturtevant Elbow Axial Flow fans . . . 28 strong, right down the rooftop.

Strong north winds can't "back pedal" those fans . . . and rain is completely shut out. Motors, bearings and belts are located outside the air stream, an industry-proven advantage in exhausting corrosive fumes.

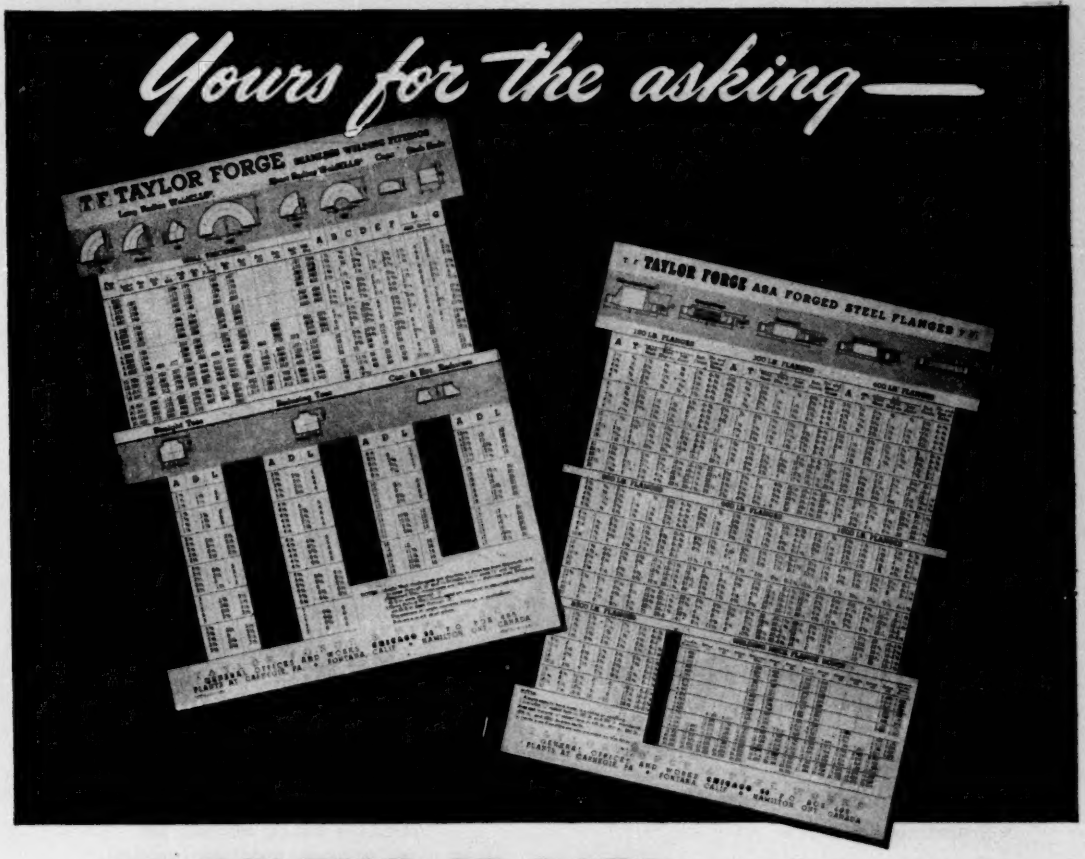
To meet the need for efficient fume or vapor removal in your plant—as well as air conditioning, air handling or air cleaning—there is Sturtevant equipment specifically designed to help you put air to work. Contact your local Sturtevant office, or write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.

YOU CAN BE SURE...IF IT'S **Westinghouse**

PUTTING Air TO WORK

J-80209

Yours for the asking—



A VOLUME OF DATA

. . . covering welding fittings and forged steel flanges . . .

ON A SINGLE SHEET

Here is just about the handiest tool ever devised for the pipe designer. Data on welding fittings and flanges that otherwise could be found only by plowing through many catalog pages and tables have been ingeniously condensed on the two sides of the durable letter-size card illustrated above.

One side covers the broad WeldELL line of Taylor Forge welding fittings. For every nominal pipe size, ½" through 30", it shows the wall thickness for every weight of every fitting in every available material. It also shows all required dimensions of all types of fittings.

The other side covers the world's most complete line of forged steel flanges. For every nominal pipe size, ½" through 24", it gives all essential dimensional and bolting data for all types of flanges in all weights. A particularly useful table (see reproduction) is that showing welding neck flange bores which enables you to determine the I.D. of any nominal pipe size without separate calculation. Thus the sheet gives you O.D. and I.D. of any weight of pipe.

The card is varnished to make it stand the steady usage you are certain to give it. To obtain your copy see your Taylor Forge distributor or **MAIL THE COUPON.**

TF

TAYLOR FORGE

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Please send me one of your fitting and flange sheets:

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511-1051

ANOTHER EXAMPLE OF versatility

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DRAVO HEATERS HELP FEDERAL-MOGUL CORPORATION SOLVE A FOUNDRY VENTILATING PROBLEM

10 DRAVO *Counterflo* HEATERS . . .

- **Keep atmosphere healthy**
- **Equalize pressure**
- **Provide constant temperature**
- **Increase employee morale**
- **Improve efficiency**
- **Step up production**

At Federal-Mogul Corporation's non-ferrous foundry in Detroit, exhaust equipment removes 400,000 cu. ft. of contaminated air per minute to eliminate smoke, fumes, dust and excessive heat. During warm weather, make-up air comes from open windows and doors. But providing warm make-up air in winter was a difficult problem, for natural infiltration did not supply sufficient make-up air and what did enter chilled the working area.

Federal-Mogul solved this by installing 10 Dravo *Counterflo* Heaters at strategic locations in the foundry. Mounted horizontally or vertically, each heater, equipped with automatic modulating controls, produces 22,000 cu. ft. of even temperature air per minute. Heaters are shut down at night, but heat the building quickly next morning. In summer, the units are used for fresh air ventilating.

RESULTS: Normal atmospheric pressure maintained, facilitating exhausting of heavy gases; improved comfort; healthier working conditions; increased worker efficiency; improved morale, better production records!

VERSATILE DRAVO HEATERS ARE AT WORK IN MANY TYPES OF INDUSTRIAL AND COMMERCIAL APPLICATIONS

Dravo *Counterflo* Heaters are ideal for space heating and ventilating in warehouses . . . machine shops . . . railroad repair shops . . . process industries . . . stores . . . schools . . . churches . . . military installations.

DRAVO HEATERS OFFER YOU . . .

- **Low initial cost . . . users report 30% to 60% savings.**
- **Concentration of heat at working level.**
- **Low Fuel consumption . . . burn gas or oil . . . easily converted.**
- **Automatic Control . . . on-off or modulating controls.**
- **Long service life, low maintenance . . . stainless steel combustion chamber.**
- **Mobility . . . easily moved to any location.**
- **Flexibility . . . where floor space is limited, can be wall-hung or suspended from trusses.**

We will be glad to send you more information about heating and ventilating with Dravo *Counterflo* Heaters. Write today for Bulletin No. PQ- 26-7980.

DRAVO CORPORATION

HEATING DEPARTMENT
Dravo Bldg., Fifth & Liberty Ave.
PITTSBURGH 22, PA.

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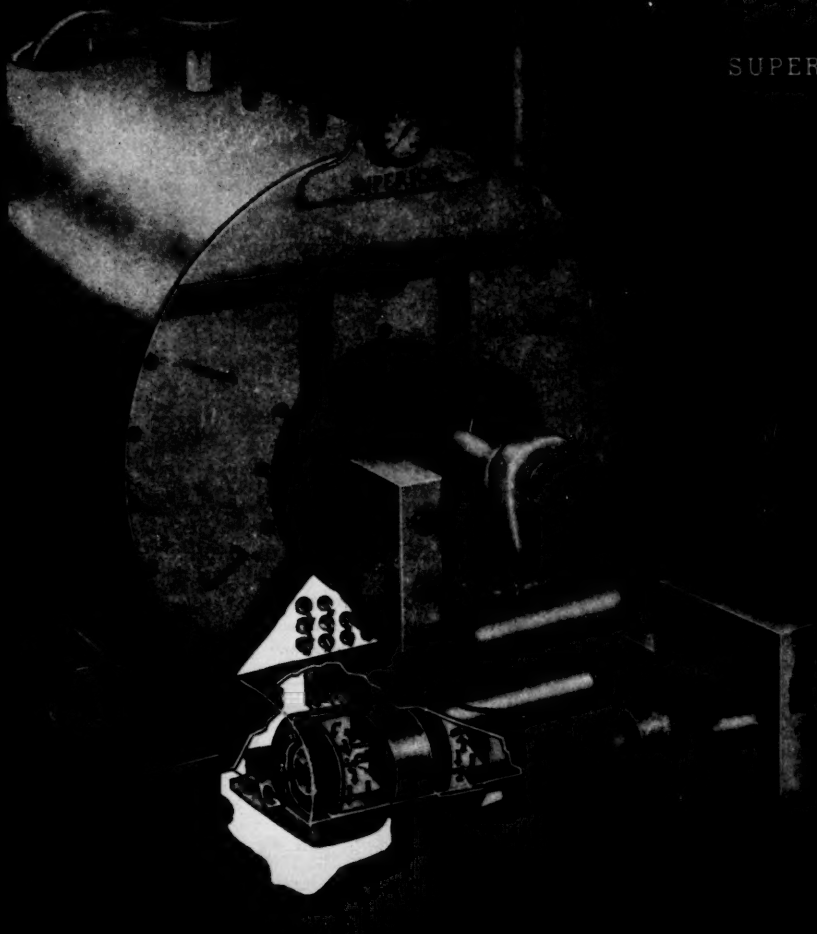
BETTER *because it's* BUILT-IN

SUPERIOR S INDUCED DRAFT



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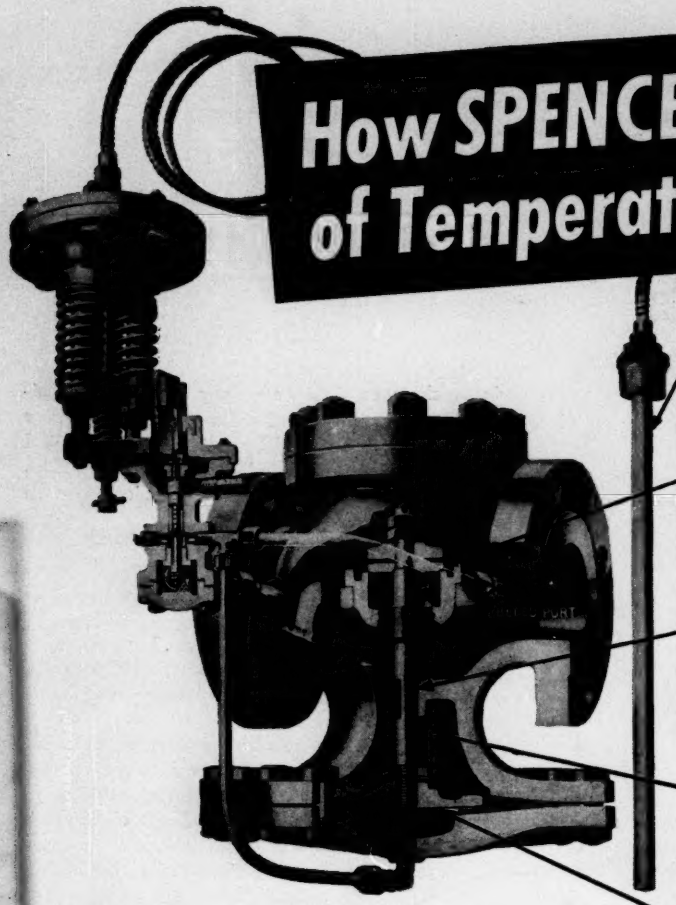
How SPENCE Cuts Costs of Temperature Control



NEW THERMOSTAT ELEMENT—Improved to practically eliminate loss of filling. Rugged construction; cannot be injured by overheating.

SECO METAL—Seats and discs are made of SECO Metal—guaranteed not to wire-draw.

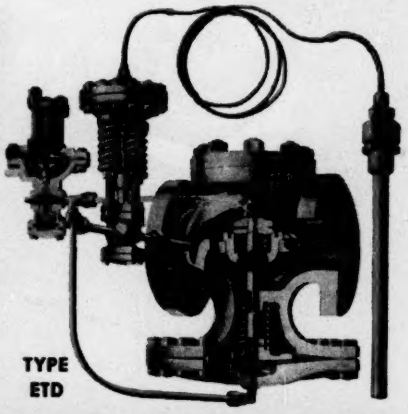
PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

PROTECTED SPRINGS — Springs in the Spence Regulator are out of the path of the steam or other fluid flowing through the valve.

LARGE BALANCED DIAPHRAGM— Spence metal diaphragms, under usual conditions, never require replacement.

Accurate Control for Both Storage and Instantaneous Heaters

Spence Temperature Regulators reduce the steam pressure and also accurately modulate the flow as required to control the temperature. No separate reducing valve is necessary • The Spence ET150 Regulator is recommended for heater pressures up to 50 psi. For higher pressures the Type ETD is available • For complete details on the entire Spence line of automatic regulating valves, strainers and desuperheaters, write for Bulletin 1200.



TYPE ETD

SK 111

Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

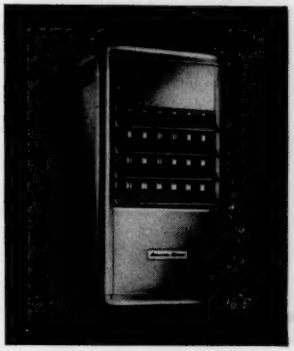
American Blower—a time-honored name in air handling

Look before you buy. There's a big difference in quality, design, quietness, operating costs and efficiency between American Blower and other air handling equipment. Comparison tests prove the superiority of American Blower products.

In Kansas City, Mo., as in other cities, American Blower Air Handling Products serve commerce, industry and public utilities. For air handling data in the Kansas City area, call American Blower—Victor 7181. Elsewhere, consult your phone book.

Product of the month

American Blower Gas-Fired Unit Heater, built in 7 sizes, capacities from 70,000 to 230,000 BTU per hour input. Write for Bulletin 7117.



Now you can buy American Blower Gas-Fired Unit Heaters

American Blower, pioneer of lightweight unit heaters for steam and hot water systems, offers a complete line of self-contained gas-fired models for a wide range of industrial and commercial applications.

Check these quality features: sturdy steel casing, with baked-enamel finish, bonderized against rust; operates with manufactured, mixed, natural or liquefied petroleum gases; aluminized steel combustion chamber to withstand high temperatures and resist corrosion; quiet, efficient operation; A.G.A.-approved.

Your heating supply house carries a complete line of American Blower Gas-Fired Unit Heaters in sizes and capacities to meet your requirements. If they cannot supply you, call the nearest American Blower Branch Office.

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CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

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Serving home and industry

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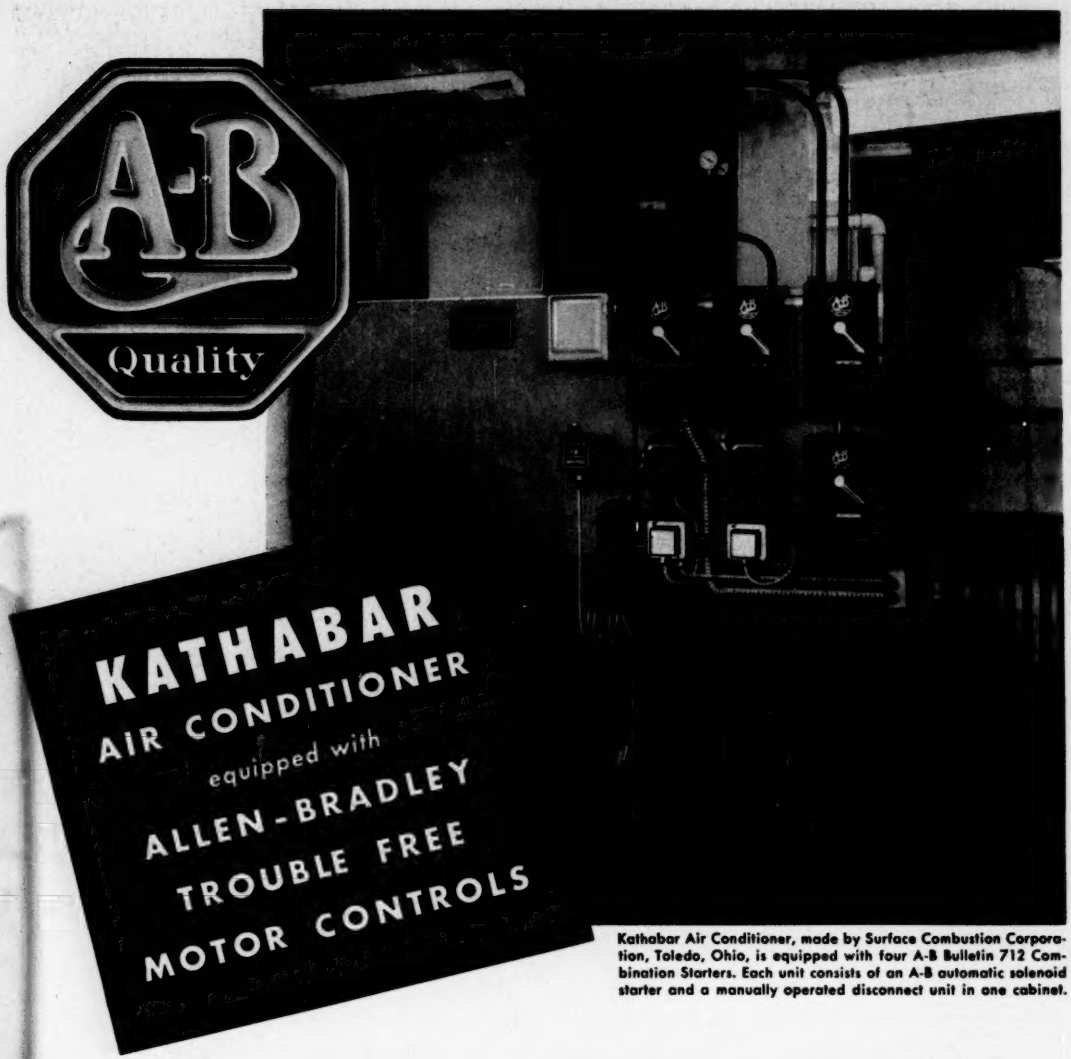
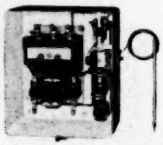


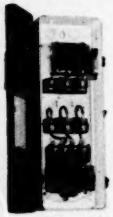
Kathabar Air Conditioner, made by Surface Combustion Corporation, Toledo, Ohio, is equipped with four A-B Bulletin 712 Combination Starters. Each unit consists of an A-B automatic solenoid starter and a manually operated disconnect unit in one cabinet.

A-B Special Refrigeration Control Unit



Allen-Bradley offers a wide line of special refrigeration control panels . . . all the necessary controls in one enclosure. Pressure and temperature controls, manual and automatic starters are mounted on one panel.

A-B Bulletin 712 Combination Starter



Bulletin 712, Size 1, Combination Starter with fuse clips in pressed steel enclosure. A-B Combination Starters reduce installation time, save space, result in a neater wiring job, and provide extra safety. Trouble free.

Why are Allen-Bradley automatic starters so popular for refrigeration and air-conditioning service? . . . Because they are trouble free. Only ONE moving part. No pivots, pins, or bearings to corrode or stick . . . no jumpers to break. You install them . . . and forget them!

No contact maintenance . . . Allen-Bradley patented silver alloy contacts never need cleaning, filing, or dressing.

Dependable overload relays . . . Allen-Bradley thermal relays are accurate and always dependable . . . even after long service.

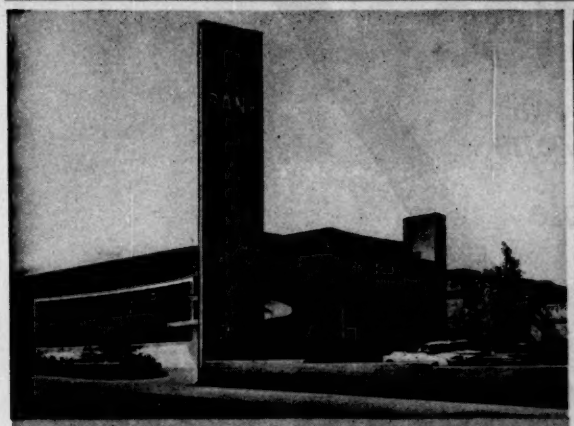
The Allen-Bradley trademark stands for millions of trouble free operations.

Allen-Bradley Co.
1330 S. Second St., Milwaukee 4, Wis.

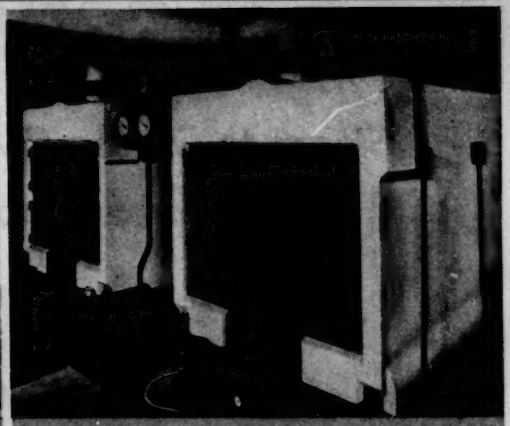
ALLEN-BRADLEY SOLENOID MOTOR CONTROLS

AMERICAN-Standard

First in heating...first in plumbing



Sixth and Denny Branch of Seattle-First National Bank. Architect: John W. Maloney, A.I.A.; Mechanical Engineer: DeWitt C. Griffin & Associates; Mechanical Contractor: Eastman Plumbing & Heating Co.; General Contractor: General Construction Co. All are Seattle firms.



A battery of two or more Redflash Boilers provides a heating plant of extreme flexibility. In cold weather the entire battery will steam up to take care of the load. On mild days the fluctuating demand for heat can be efficiently handled by one of the boilers, thus effecting desirable economies in fuel.

Seattle's Most Modern Bank installs Redflash Boilers

Newest branch is fifth in large state-wide system to be heated by AMERICAN-Standard equipment

● One of the nation's fastest growing banks is the Seattle-First National. And it is one of the most progressive. Operating a state-wide system of branch offices, this great institution now ranks 24th in deposits among all banks of the country.

The attractive building shown above is the fiftieth and newest branch to be opened. Known as the Sixth and Denny Branch and located in the heart of Seattle's northern downtown business district, this modern banking building incorporates many unique banking facilities, including drive-in banking and a large parking area.

Another feature which reflects this important bank's sincere interest in the health and comfort of its customers . . . and its own personnel, is the installation of two American-Standard Redflash Boilers to insure dependable and efficient heat and operating economy. Redflash Boilers have also been installed in four other recently opened branches.

Redflash boilers provide economical heating for your commercial jobs!

Expertly engineered and sturdily constructed, the Redflash Boiler can be installed singly or in battery to provide an abundance of heat for large residences or commercial buildings of practically any size. Its scientifically proportioned combustion chamber, direct heating surface, and long flue travel for hot gases assure highest heat output with the least fuel. The Redflash Boiler and other large fired heating units in the American-Standard line are sold through selected wholesale distributors to heating and plumbing contractors.

Easy to Install...

Redflash Boilers are shipped in sections, so that even the largest size is easily moved through a door or elevator hatch. Can be assembled quickly without tearing down walls or shifting heavy equipment.

American Radiator & Standard Sanitary Corporation, P. O. Box 1226, Pittsburgh 30, Pa.

Serving home and industry

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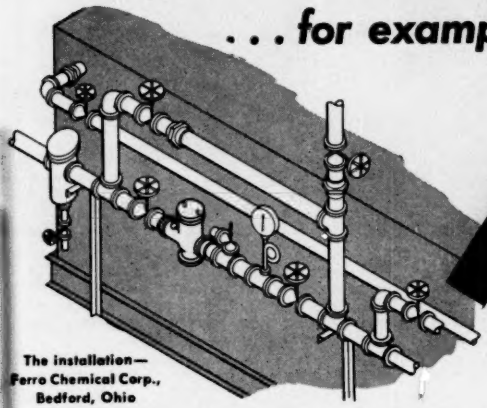
for outstanding service

on Steam to Drying Ovens . . . for example



The installation—
Ferro Chemical Corp.,
Bedford, Ohio

PROBLEM: To maintain automatically, within close limits, uniform reduced steam pressure from supply line to battery of two drying ovens controlled by individual thermostatic valves.

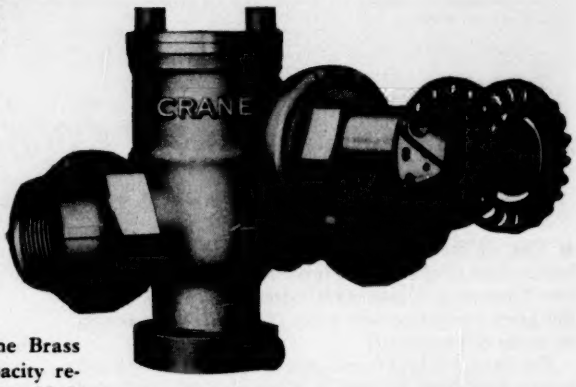
WORKING CONDITIONS: Initial steam pressure of 70 psi to be reduced to 13 psi, and maintained without significant fluctuation whether one, both, or neither of the ovens is being operated.

SOLUTION TO PROBLEM: One No. 960 Crane Brass Pressure Regulator, properly selected for capacity required, and with adequate condensate drainage provided.

RESULT: For more than 5 years, without interruption and with no more than routine maintenance, the Crane No. 960 Regulator has given complete satisfaction. Operating like new, and since all wearing parts are renewable, it will virtually never wear out. User remarks on unusual simplicity of adjustment.

Another typical case history, demonstrating the bigger value and lower ultimate cost of Crane Quality Valves. And why . . . More CRANE VALVES are used than any other make!

. . . Install Dependable Quality CRANE VALVES



No. 960 Crane Brass Pressure Regulator for steam or air. Literature on request through your Crane Branch or Crane Wholesaler.

CRANE CO.

General Offices:
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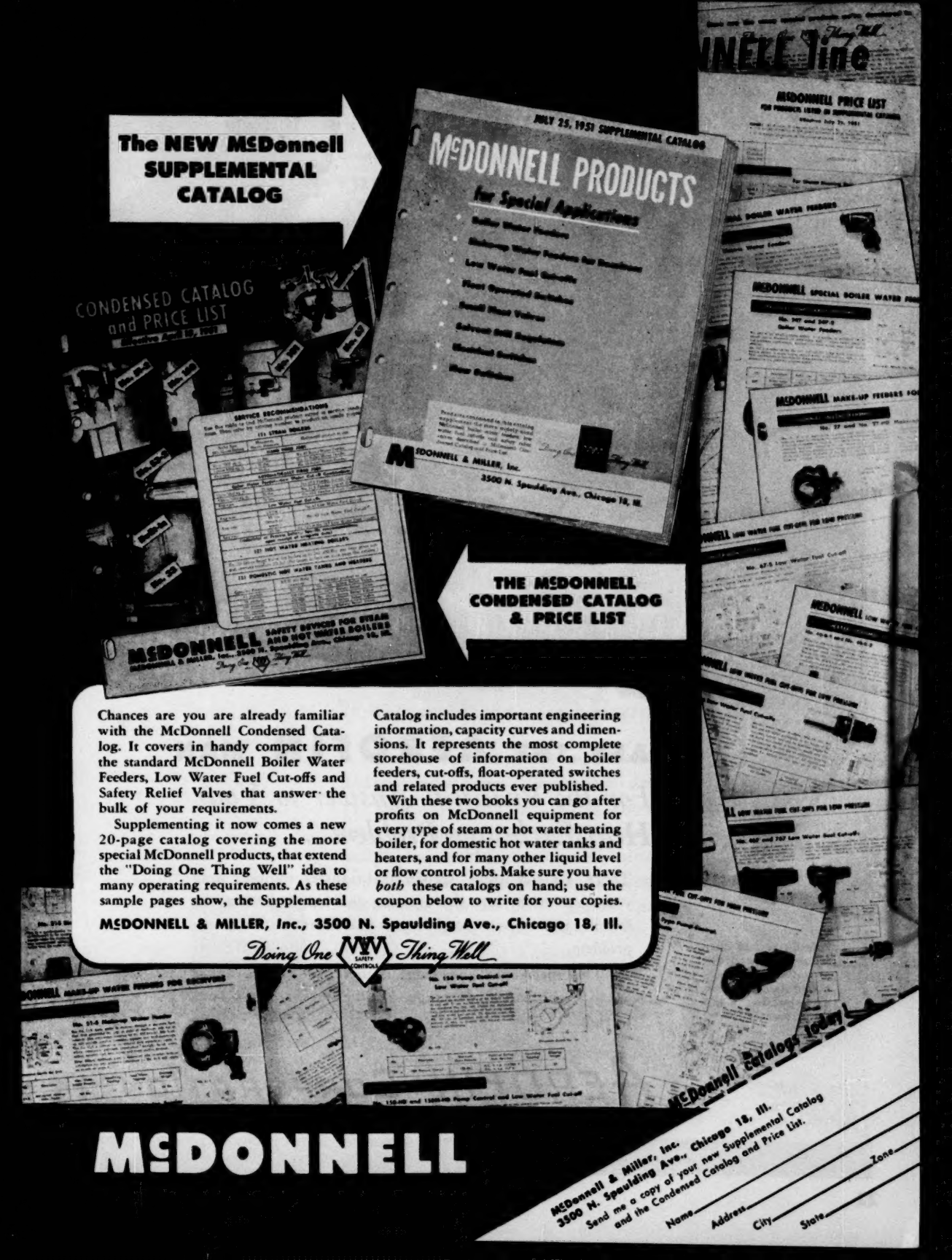
VALVES • FITTINGS • PIPE • PLUMBING • HEATING


The NEW McDonnell SUPPLEMENTAL CATALOG
JULY 25, 1951 SUPPLEMENTAL CATALOG
McDONNELL PRODUCTS
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THE McDONNELL CONDENSED CATALOG & PRICE LIST
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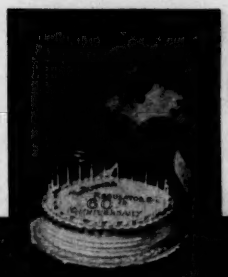
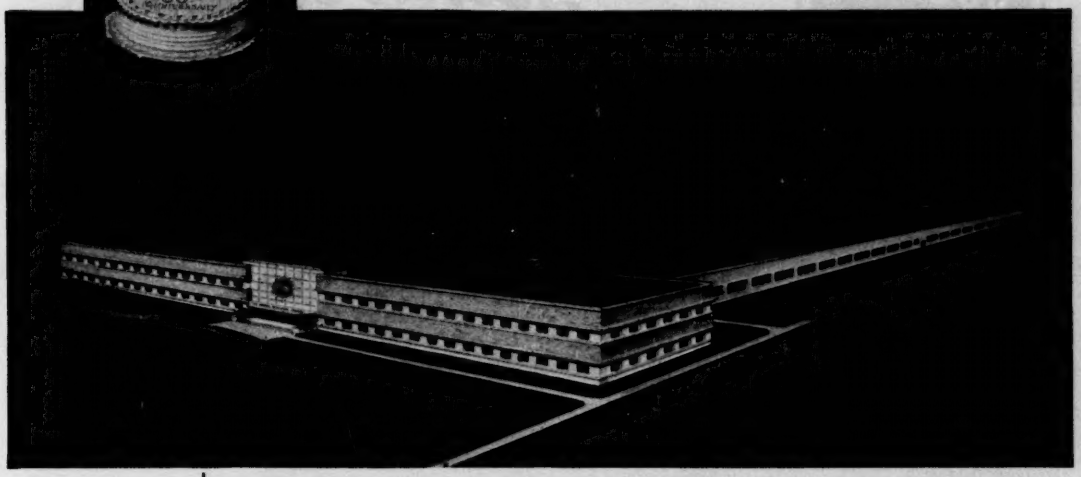


Commemorating our 60th Anniversary

THE POWERS REGULATOR COMPANY



New Factory and General Office Building: 3400 Oakton Street, Skokie, Illinois

World's Most Modern Factory Producing Automatic Temperature and Humidity Control

. . . to meet the greatly increased demand for POWERS products and to give you better controls, better deliveries and better values . . . these advantages are possible with our large new plant and modern production facilities. With an enlarged engineering and production staff, plus 60 years experience in heating, ventilating, air conditioning and process control, we believe we can be of greater service than ever before to our many friends who have contributed to our success.

WILLIAM PENN POWERS
. . . with his invention of the first all pneumatic system of temperature control and gradual acting vapor disc thermostat made an invaluable contribution to the modern science of heating, air conditioning and industrial process control.

POWERS CONTROL — 60th ANNIVERSARY 1891 1951

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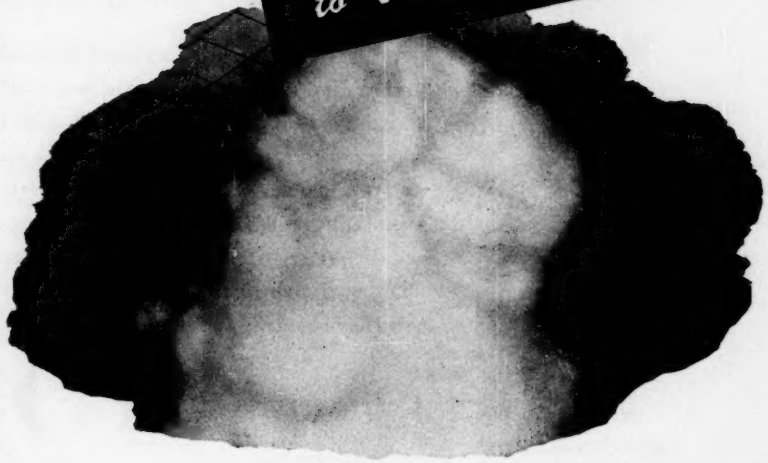
ADJUSTABLE AIR PATTERNS

MODEL "J" CEILING OUTLET
Circular type, surface or flush mounting, supply or exhaust or both. Integral volume control. Write for Bulletin F-4085-1.

SQUARE CEILING OUTLET
Made to fit and blend into acoustical tile ceilings. Key-operated control provides air pattern adjustment. Write for Bulletin F-4728.



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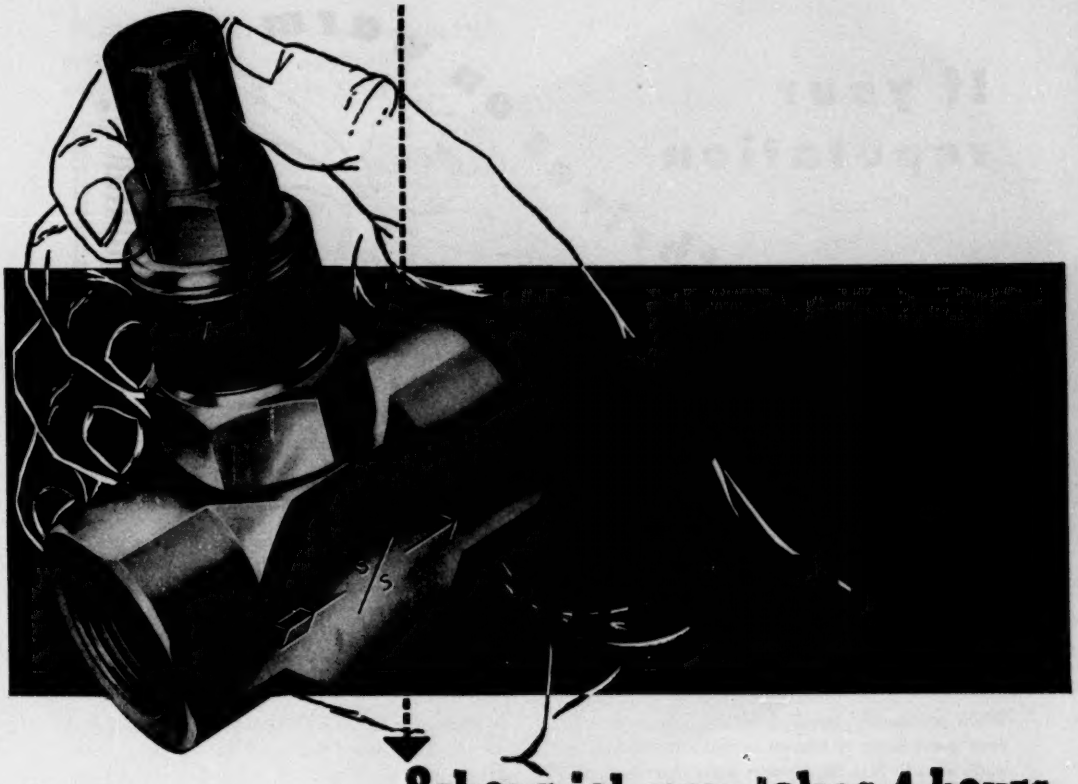

8-hour job now takes 4 hours

At a western magnesium reduction plant something besides magnesium has just been reduced. The steam at the end of the 1½ mile long steam line wasn't so hot—and neither was the production record of the plant at that location.

Then 26 old-type steam traps were replaced with Yarway Impulse Traps. Now there is only a 15° temperature drop from the boilers to the end of the line. *Most important, the plant 1½ miles from the boilers is now able to do work in 4 hours that previously took 8 hours.*

That's trap efficiency! It's evidence of the fact that Yarways are designed to send the most premium B.T.U.'s at top temperatures into your process or product. *They get equipment hotter, sooner . . . and keep it hot.*

Other Yarway features—small size, one moving part, easy installation, low maintenance, low cost, stainless steel construction. Nearly 750,000 Yarways have already been installed. For your Yarways, see a nearby industrial distributor . . . 216 stock and sell Yarways.

YARNALL-WARING COMPANY, 104 Mermaid Ave., Philadelphia 18, Pa.

FREE TRAP SELECTOR

It's important to have the right trap in the right place. New 20-page selector tells quickly and easily which *is* the right Yarway trap for any application. Write for your free copy.

the steam trap

designed with more production in mind

If your reputation thrives on warm air...

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Electric Motors help it grow...

When you specify, install or service furnace blowers, your good name is like an orchid. It depends on warm air. In fact the blowers must deliver warmth reliably and without fail, both for your customers' sakes and yours. That's why it's wise to rely on Hoover Motors!

Hoover furnace blower motors give smooth, quiet, dependable service. They're dripproof, equipped with automatic thermal protection, designed for a 40° C. temperature rise. They're built like motors costing far, far more.

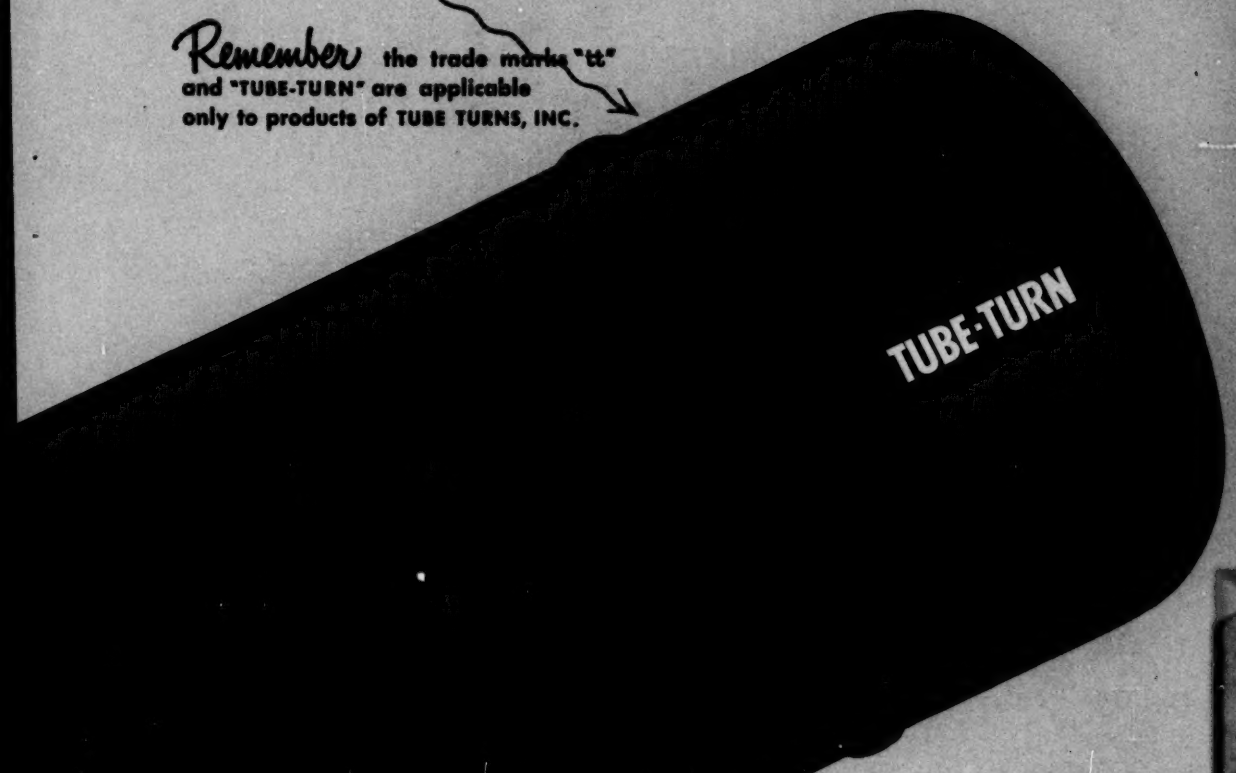
They come in different HP ratings, both split-phase and capacitor-start. So there's sure to be a Hoover Motor to fit any furnace blower you install or service —a Hoover Motor to help that blower satisfy your customer, to help your reputation grow!

Hoover Furnace Blower Motors available in ratings of ⅛ HP through ⅓ HP split-phase, and ½ HP through ¾ HP capacitor-start. All feature 1725 RPM speed, Gits oilers and a resilient base built to meet NEMA mounting standards. Automatic thermo protectors have been checked and approved by Underwriters' Laboratories.

Write today for complete information—on furnace blower motors or on motors built for other purposes.

THE HOOVER COMPANY
Kingston-Conley Division
68 Brook Avenue
North Plainfield, New Jersey

Remember the trade marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS, INC.



the engineered way to put an end to a pressure problem

WHEN IT COMES to containing pressures—in a header or pressure vessel or in merely blanking off a line—your safest, surest bet is a TUBE-TURN Welding Cap. Formed to 2:1 semi-ellipsoidal contours, it represents the ideal pressure-resisting closure for a cylinder. No makeshift capping method can approach its bursting strength which is actually far greater than seamless tubing of like thickness and grade of steel.

Another important point: TUBE-TURN Welding Caps are manufactured to meet ASME Boiler Code requirements and the chemical-physical standards of ASTM specification A106 for Grade A and Grade B carbon steels.

For welding caps and for all TUBE-TURN Welding Fittings and Flanges, see your nearby TUBE TURNS' Distributor. You'll find one in every principal city.

Write Dept. B-10 for free booklet giving Dimensional Data on types, sizes and materials of TUBE-TURN Welding Fittings and Flanges.

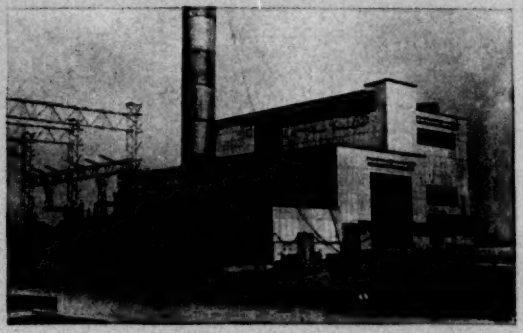
"Be sure you see the double tt

TUBE TURNS, INC. LOUISVILLE 1, KENTUCKY

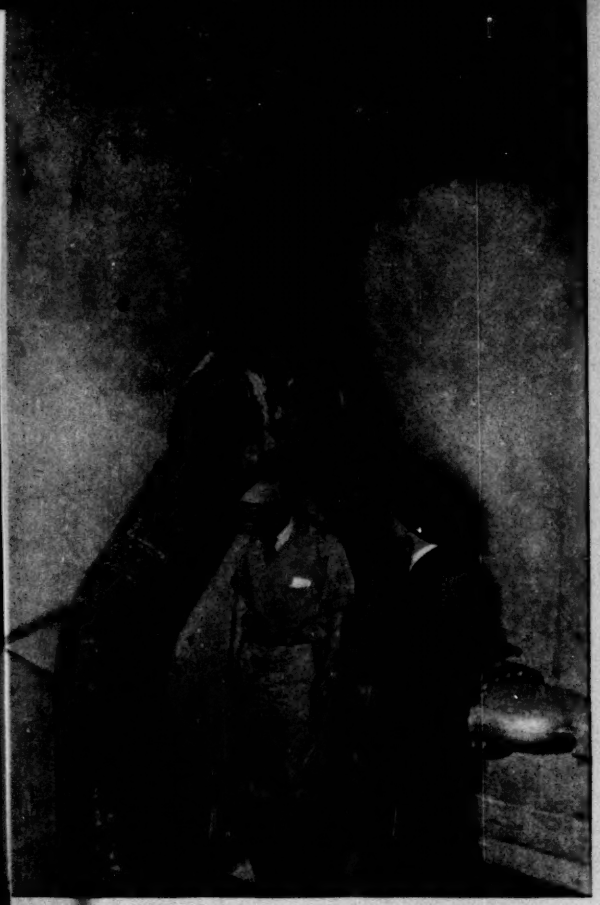
DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Houston • Tulsa • San Francisco • Los Angeles

TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO... A wholly owned subsidiary of TUBE TURNS, INC.

New Ford Power Plant features welded piping



Power station for Ford Motor Company's giant new engine plant and foundry, now being built in Cleveland; F. A. Fairbrother —Geo. H. Miehls, Architect and Engineer; Albert Kahn Associates, Consultants. Engine plant will be equipped with the last word in automatic machinery—to save production man-hours. The designers believe in saving maintenance man-hours too. Thus at the power plant, which will supply 360,000 pounds of 150-lb. steam per hour for heating and process, an all-welded piping system with TUBE-TURN Welding Fittings and Flanges was specified. Welded steam, air, and condensate lines are permanent and leakproof.



Here the 18" steam main from the power plant leads to a fabricated "Y" connection, then through tunnels to foundry and engine shop. One side is stepped down through a TUBE-TURN Welding Reducer to a 16" line; the other side through another TUBE-TURN Welding Reducer to a 12" line. Special "Y" connection was made by cutting and welding two 45° Welding Elbows, a job that calls for uniform wall thickness and concentricity throughout the fittings—a point of pride with TUBE TURNS, INC.

In engine shop, smaller lines designed to carry coolant oil to machine tools are also welded. Wide range of TUBE-TURN Welding Fittings and Flanges—including more than 4000 different items—simplifies installation job. Leakproof piping will free maintenance personnel for other work.

Despite close quarters in tunnel, fabrication goes ahead swiftly. Welders and contractors like to use TUBE-TURN Welding Fittings because they know that dimensions are always accurate, thus line-up is easy. Welded lines can be fitted closely together, will make for a neat installation. With no flanges to work around, insulation can be applied easily.

TUBE TURNS, INC., Dept. B-10
224 East Broadway, Louisville 1, Kentucky

Your Name .....

Position .....

Company .....

Nature of Business .....

Address .....

City ..... *State* .....

DISTRICT OFFICES

New York	Houston
Philadelphia	Tulsa
Pittsburgh	San Francisco
Chicago	Los Angeles

"tt" and "TUBE-TURN" Reg. U.S. Pat. Off.

TUBE TURNS, INC.

LOUISVILLE 1, KENTUCKY

HURRY! HURRY!

see 'em alive and in the flesh
at the 7th All-Industry Show in Chicago
ALCO's Booth No. 247

Here's your chance to see ALCO's prize collection of refrigeration "brains"—the most outstanding group of its kind ever gathered together. They walk, they talk—and that's not all! Watch 'em perform when you feed 'em tough refrigeration problems.

Seriously, ALCO and each of the "fine specimens" shown above, invite you to visit Booth No. 247 for an enjoyable and profitable get-together. A complete display of all the latest ALCO valves and equipment will be there for you to see.

ALCO VALVE CO.

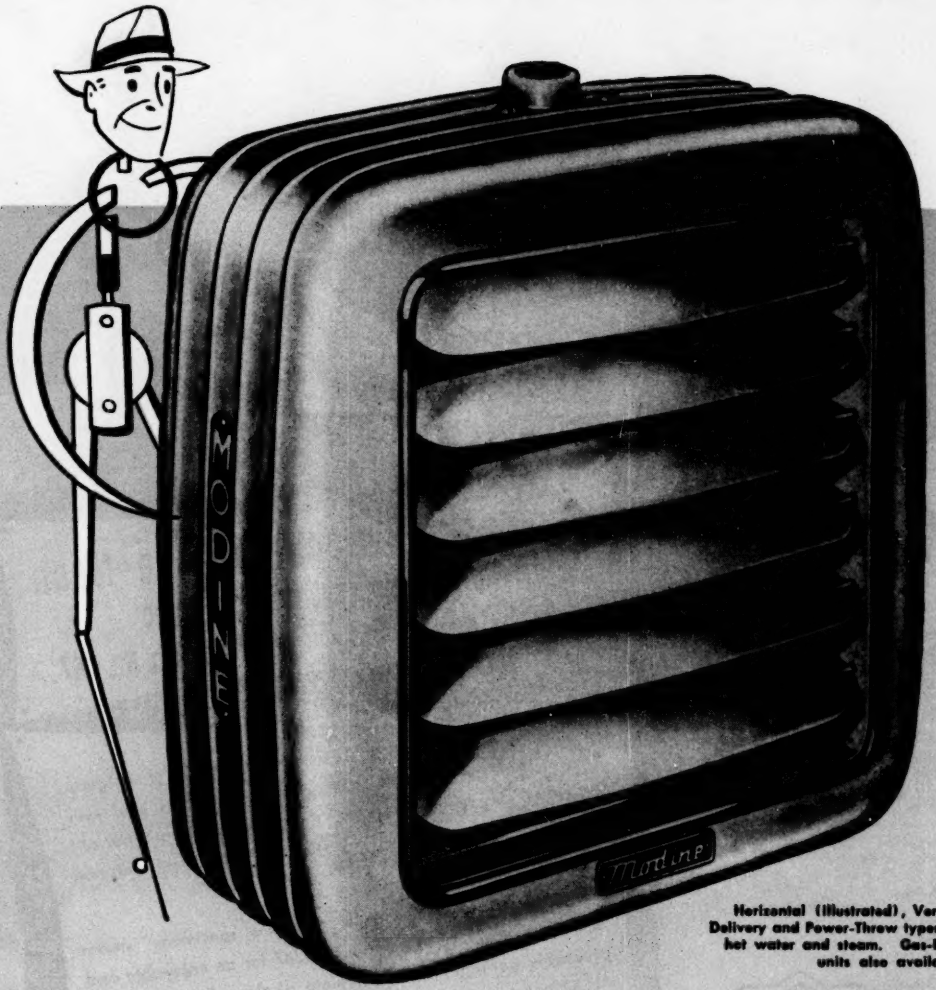
859 KINGSLAND AVE. • ST. LOUIS 5, MO.

4861

Designers and Manufacturers of Thermostatic Expansion Valves, Evaporator Pressure Regulators; Solenoid Valves, Float Valves; Float Switches

COMPARE

. . . ON EVERY COUNT MODINE UNIT HEATERS STAND OUT



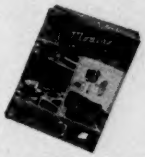
Horizontal (Illustrated), Vertical Delivery and Power-Throw types for hot water and steam. Gas-Fired units also available.

Modine UNIT HEATERS

U-1123

Advanced engineering . . . superb styling . . . highest grade materials and craftsmanship—all quality hallmarks of Modine Unit Heaters. They're your assurance of *heating performance at its best* — high fuel economy . . . years of trouble-free service. Built to a standard of excellence — Modine is the choice for unfailing dependability, lower operating and maintenance costs. So whether you need Horizontal Delivery models (illustrated), Verticals or Power-Throws — *compare first!* Modine Mfg. Co., 1511 DeKoven Ave., Racine, Wis.

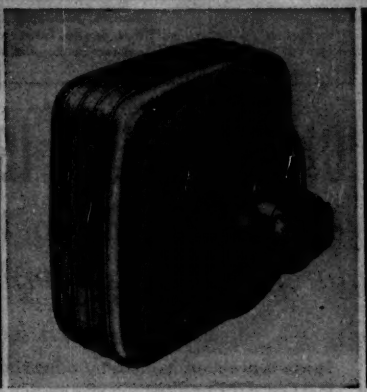
ENGINEERS RATE MODINE THE STANDARD OF EXCELLENCE



Write for Bulletin 149-A, "Modine Unit Heating." Or contact your Modine representative listed in your phone book classified section.

Six of many outstanding features that account for the Modine quality reputation

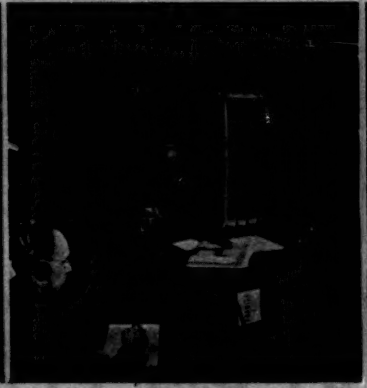
Discharge air temperatures of 110° to 120° F. are correctly related to air velocities — assure perfect heating comfort plus lower fuel costs.



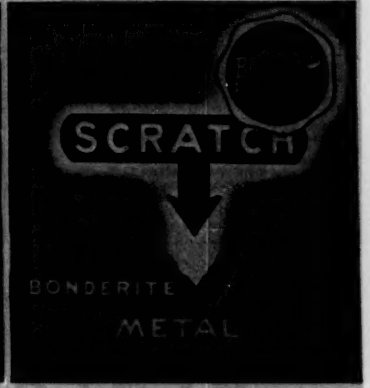
Sturdy, steel, integral fan guard offers safety from exposed fan — serves as a resilient, vibration-absorbing mounting for the unit's motor.

Built-in velocity generator effectively steps up heat throw. This assures positive heat penetration of the cold air strata that is near the floor.

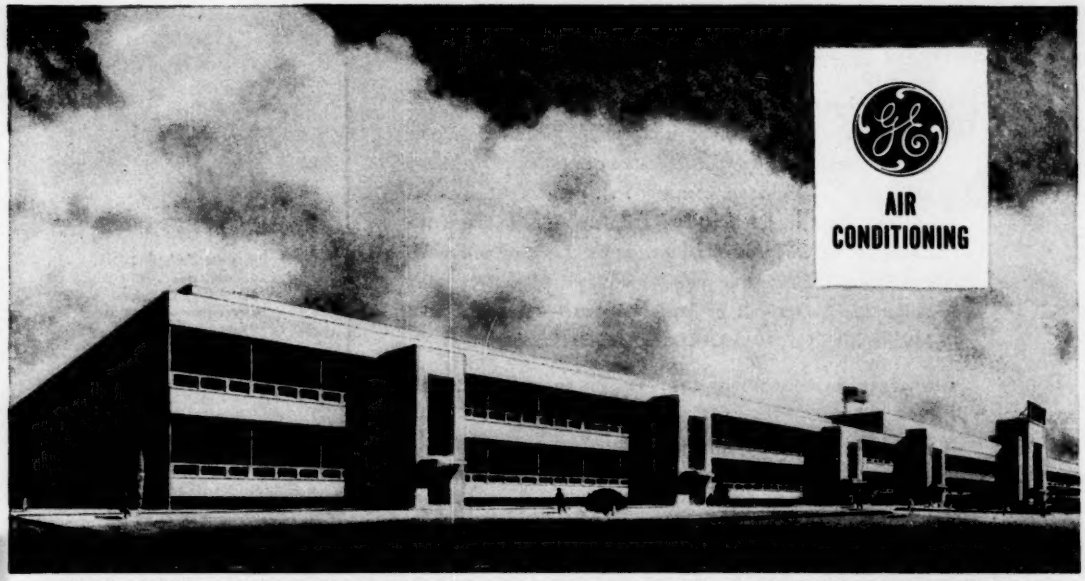
Direct-from-pipe suspension is safe and economical, with no hanger-rods. Heated air stream may be easily redirected over full 360° range.



Sound-silencing features assure quieter operation — certified by accurate laboratory sound ratings. Especially important for commercial and institutional use.



Parker-Bonderizing provides rust-resistance for casings and other sheetmetal parts — anchors paint to steel — preserves the fine finish longer.



COMPLETE NEW WING of International Business Machine Corporation's Poughkeepsie, N. Y. plant (above, left) will be heated (cooling by same units to be added later) by 123 G-E Central Plant Air Conditioners. Architects and consulting engineers: Lacey, Atherton, & Davis; Seelye, Stevenson, Value & Knecht. General contractor: Sordoni Construction Co., Inc. Air conditioning contractor: Mance Corporation.

G-E AIR CONDITIONING HELPS IBM SAVE SPACE

Compact G-E System planned to provide heating now— add cooling later without altering ductwork

Motor mount always right side up
Space-saving filter section
Face, by-pass dampers control humidity
Expandable coil section, changed easily

Sound investment. G-E Air Conditioners (vertical model shown) are so compact, quiet, handsome, they're often installed in open. Thanks to "Building Block" design, you select from 40 different arrangements. Helps you save engineering, installation time and space.

Space is precious in modern industrial plants. That's why flexible, economical G-E Air Conditioning was chosen for the new addition to IBM's Poughkeepsie, N. Y. factory.

On upper floors, compact G-E *vertical* air conditioners fit into return air passages. On the ground floor, G-E *horizontal* units—good-looking and quiet—are hung from the ceiling right in the area each one serves.

Easy to add cooling. At first, only heating, ventilation, and filtered air will be provided. It's planned that the same units will later provide cooling. To do this, proper coil space has been provided so that ducts won't have to be altered. Disturbances to production will be at a minimum.

Write now for free data on G-E Air Conditioning Systems that improve efficiency in industry, boost profits in hotels, apartments, office buildings...or see your architect, engineer, contractor. Ask, too, about convenient, economical G-E Drinking Water Coolers for offices and factories. General Electric Company, Air Conditioning Division, Sec. HV-21, Bloomfield, N. J.

You can put your confidence in—

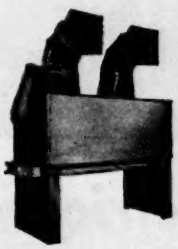
GENERAL ELECTRIC

SAVE THE HOT AIR!

McQuay DOWN FLOW UNIT HEATERS

Save the hot air ordinarily wasted in buildings with high ceilings with a McQuay Down Flow Unit Heater. These vertical unit heaters have the famous Ripple-Fin Coils—providing peak heating efficiency—will lower your heating costs by circulating evenly and gently this normally wasted stratified air. There are 22 Down Flow Units available to meet your exact requirements. Capacity range from 25,400 to 500,000 B.T.U. per hour.

Consult the McQuay representative in your city, or write McQuay, Inc., 1619 Broadway St. N.E., Minneapolis 13, Minn.



HORIZONTAL UNIT HEATERS

These unit heaters are offered for normal applications where horizontal air flow is desired. In 24 sizes with capacities ranging from 20,300 to 360,000 B.T.U. per hour.

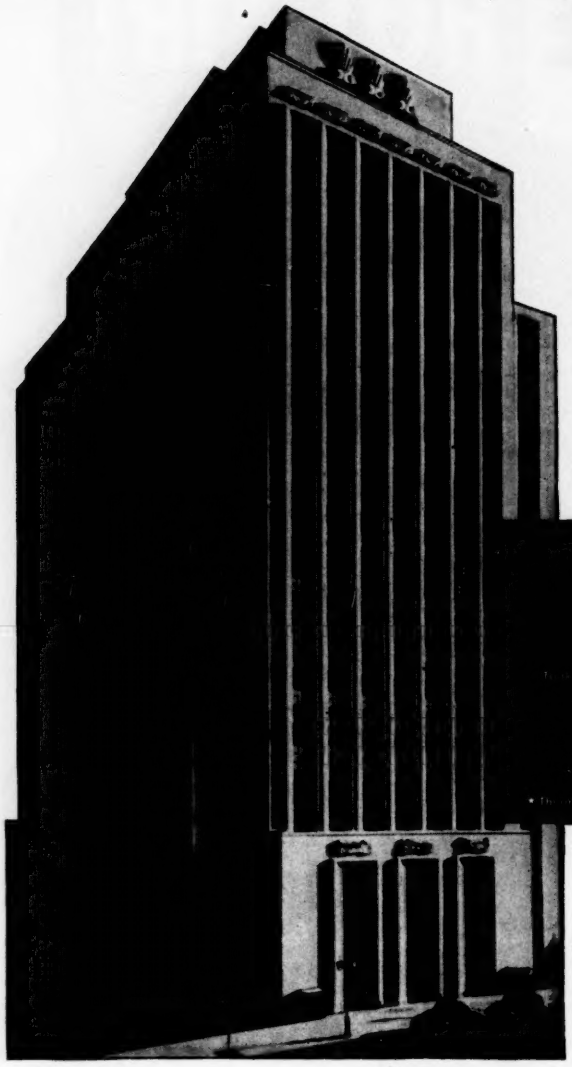
BLOWER TYPE UNIT HEATERS

For effective heat distribution over large open areas. Available in 8 sizes . . . in suspended and floor models, with one and two row coils; capacities from 20,600 to 1,600,000 B.T.U. per hour.

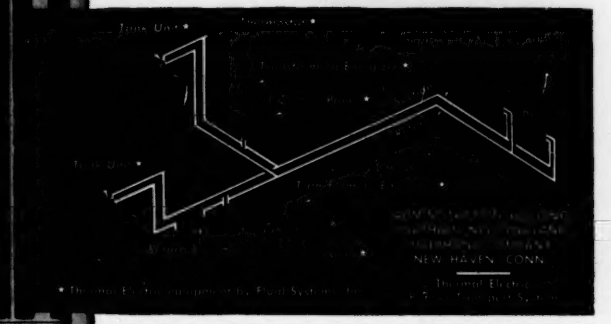
McQuay INC.

HEATING • AIR CONDITIONING • REFRIGERATION

How 'Telephone' Solved the Bunker Problem



TELEPHONE companies have to be tough customers when it comes to oil burning equipment. They demand a plant which will give them heat at any time, even during the summer, for keeping delicate dial mechanisms dry. During hurricanes, blizzards, and other emergencies, the heating equipment cannot fail. ☆ The Bell Laboratories approved the Thermal Electric method for transporting heated bunker fuel in 1938. Since then, six leading Bell subsidiaries have installed it to solve the problem of swift and certain startups after shutdowns of any duration. ☆ The Southern New England Telephone Company has had thirteen years' experience with Thermal Electric. They have found it so successfully met their operating requirements that they've installed it in twenty of their buildings.



How It Works: The Transforming Energizers pass safe 20-volt current through the pipes that carry the fuel, generating heat at 100% efficiency. Thermostats and Control Panels regulate fuel temperature at 120°F., making system fully automatic. The Tank Units remove fuel from *unheated* underground storage tanks. Thermal Electric works with any burner. Southern New England Telephone uses it with Ray, York, Petro, and Johnson burners.

PAT. NO. 2,224,403 HVS-4

Thermal Electric Fluid Systems INC.

Fluid Systems, Inc., 1881 Dixwell Ave., New Haven, Conn.

Please send without obligation "The Common Sense of Heavy Fuel Transport" plus Customer List of hundreds of users, including telephone companies.

*Name*_____

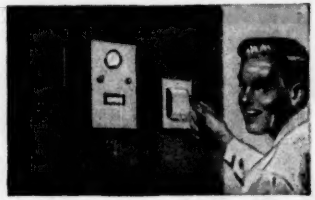
*Firm*_____

*Street*_____

*City*_____ *State*_____

☐ P.S. Send the proof about that three-year shutdown!

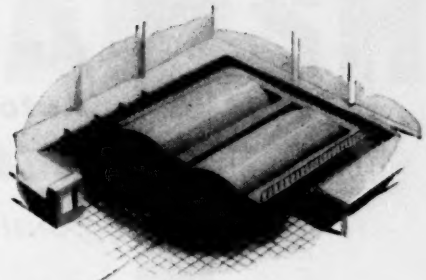
Thermal Electric and Fluid Systems, Inc. are trade marks registered in U.S. Pat. Off.

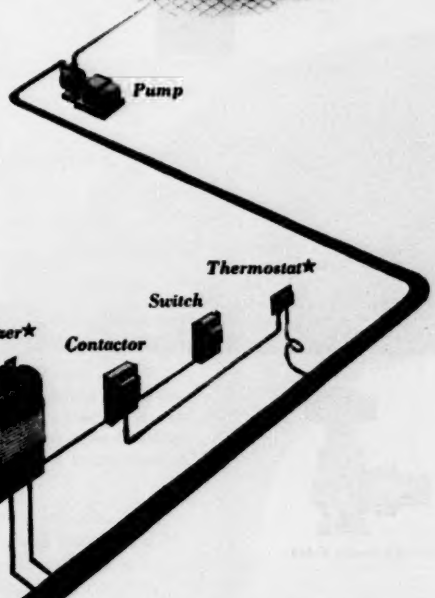


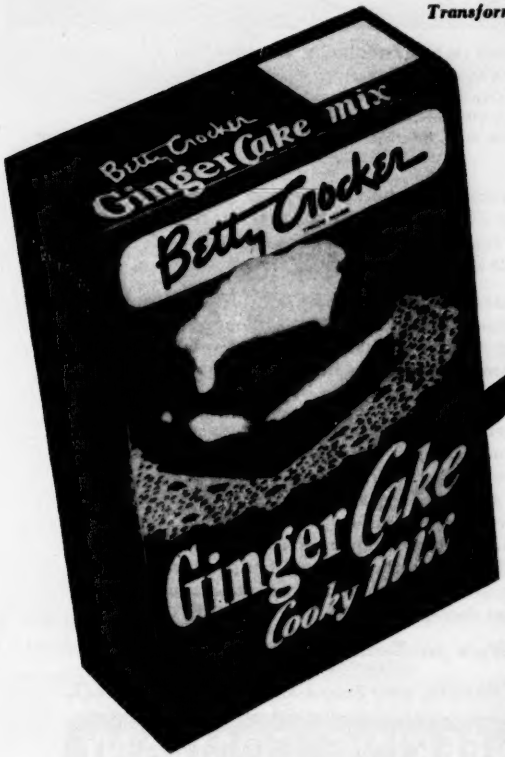
It starts at a flip of a switch! In one case, Thermal Electric started bunker flowing *immediately* after a *three-year* shutdown! Proof on request.

The Molasses System General Mills Forgot

Recently, we asked the management of General Mills' Buffalo, N. Y., plant how their Thermal Electric System was performing. They said, "Why, it must be okay — we've never paid any attention to it." All they knew was that they always had molasses flowing from their pipes at exactly the right temperature whenever they wanted it. General Mills had practically forgotten the system which pipes their molasses up seven stories at a constant 110°F. for making Betty Crocker GingerCake and Cooky Mix — and it has been in operation for over four years! What better proof could we give you to support Thermal Electric's *guarantee* of PERFECT PERFORMANCE — NO MAINTENANCE. We believe that the General Mills installation, the one the management forgot, is ample demonstration of Thermal Electric's success in handling viscous fluids. What is your fluid problem?







Thermal Electric System for molasses (or *any* fluid transport): Low-voltage current from the Transforming Energizer passes through the pipe walls, maintaining fluid contents at 110°F. and 100% efficiency. Thermal Electric also handles "touchy" fluids at various temperatures for many other leading food manufacturers. Send in for our customer list.

★Thermal Electric equipment by Fluid Systems

Consult Fluid Systems, Inc. for specialized engineering aid in designing heated pipe transport of process fluids.

PAT. NO. 2,526,403 HVI-4

Thermal Electric Fluid Systems

Fluid Systems, Inc., 1881 Dixwell Ave., New Haven, Conn.

Please send without obligation "Simplified Industrial Fluid Transport Cuts Costs" and Customer List.

*Name*_____ *Position*_____

*Firm*_____

*Address*_____

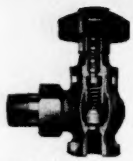
*City*_____ *State*_____

Thermal Electric and Fluid Systems, Inc. are trade marks reg. in U.S. Pat. Off.

An ILLINOIS
Automatic
HEATING SYSTEM

CONTINUOUS FLOW CONTROL
TYPE A

MORRISTOWN (N. J.) MEMORIAL HOSPITAL
JOHN H. & WILSON C. ELY, Newark, N. J., *Architects*
MEYER, STRONG & JONES, New York City, *Mechanical Engineers*
GERHARD HARTMAN, PH. D., New York City, *Hospital Consultant*
AUGUST ARACE & SONS, INC., Elizabeth, N. J., *Heating, Ventilating & Air Conditioning Contractor*



Series 48 Supply Valve

Series G Thermo Trap

Type A Valve

Enthusiastic teamwork and compact planning produced this masterpiece of building economy—a new 236-bed general hospital to serve 5 counties in Northwest New Jersey. It represents the "most beds per dollar" with direct construction costs 20% less than national average.

In keeping with this economical planning, a Type A ILLINOIS Control System was selected to represent maximum value. Although higher in first cost, its operation will reflect a sound economy year after year as well as giving the comfort and convenience of automatic heat perfectly controlled.

Three oil-fired boilers generate steam at 105 psig. for the laundry equipment. A 50 psig. system serves the kitchen, sterilizers and autoclaves. Another reduction to 10 psig. handles the air conditioning and ventilating coils, hot water generators and unit heaters. Finally, in three independently controlled zones, steam is reduced by Illinois Continuous Flow Type A valves to pressures varying from 1 lb. to 24 inches (Hg.) vacuum. Outdoor thermostats, in combination with vacuum pump controllers automatically govern the flow and temperature of steam to the standing cast iron radiators, producing a continuous output varied to meet weather demands.

Write for Bulletins

Representative, DUDLEY F. PARKER, 480 Broad Street, Newark 2, N. J.

ILLINOIS ENGINEERING COMPANY
INCORPORATED 1900
RACINE AVENUE AT 21ST STREET • CHICAGO 8

IT ALWAYS PAYS TO SPECIFY

LADISH

Controlled Quality

PIPE FITTINGS

TO MARK PROGRESS

...you get full value for every fittings dollar

The more critically you appraise value... the more you will appreciate Ladish Controlled Quality Fittings. For the ultimate economy of Ladish Fittings is assured by laboratory, engineering and manufacturing controls unsurpassed for thoroughness and rigid standards. From metallurgy through machining ... repeated tests safeguard the extra strength and soundness vital to long dependable service ... extra value you can always depend on from Ladish Controlled Quality Fittings.

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

CUDAHY, WISCONSIN
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District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
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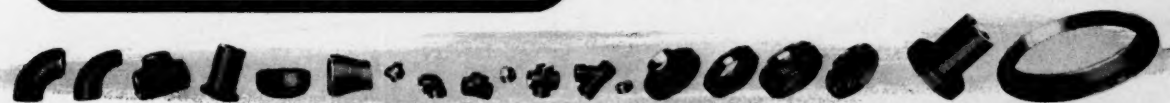


UNSURPASSED IN EFFICIENCY • ECONOMY • VERSATILITY

Staynew DRY PANEL FILTERS

Feature Pre-formed, Wire-clad Inserts

Cell removed from frame by sturdy offset handles after releasing locking cams.

Removing pre-formed Insert is simple. Snap catches are released, cover lifted off, Insert lifted out.

Dis-assembled cell showing removable cover, Insert and box containing permanent fin support.

Insert easily slipped on permanent fin support by means of special Staynew Loading Knife.

. . . *pre-formed* so that Inserts can be slipped on or off the permanent fins in seconds! . . . *wire-clad* for complete protection of medium and maximum fire resistance! . . . *Class I Underwriters' Approval* in bonded glass!

FIN CONSTRUCTION provides the greatest possible filtering area in available space. Resistance in relation to dust load is less than in panel filters built on any other principle.

OPERATING ECONOMY is amazing. The most fragile medium can be cleaned repeatedly either by vacuum or fluid (dry-cleaning). Insert replacement cost is very low.

STAYNEW DRY PANEL FILTERS are *versatile* . . . utilizing any medium in sheet form that can be crimped. Stock media include wool felt, rayon-cotton-wool felt, bonded glass, and Feltex. The latter is a surprisingly low cost, highly efficient medium.

INSTALLATION can be in flat or V-banks, frames riveted but individual cells removable in a matter of seconds. All standard sizes are available in 2″, 4″ and 8″ depths.

FOR EVERY DRY PANEL NEED there is a Staynew model and medium for maximum efficiency at minimum cost.

WRITE FOR BULLETIN DPF

Representatives in Principal Cities

DOLLINGER CORPORATION

15 CENTRE PK., ROCHESTER 3, N. Y.

DOLLINGER REG. PROTECTOMOTOR U.S. PAT. OFF. STAYNEW FILTERS

BRUNNER
SINCE 1906

BRUNNER offers YOU Air Conditioning and Refrigeration Condensing Units up to 75 tons capacity, incorporating design features providing maximum adaptability to specific application requirements.

BRUNNER offers YOU an experienced engineering staff qualified to assist in working out problems of selection, installation and operation.

BRUNNER offers YOU plant capacity and manufacturing flexibility enabling you to meet delivery as well as equipment specifications.

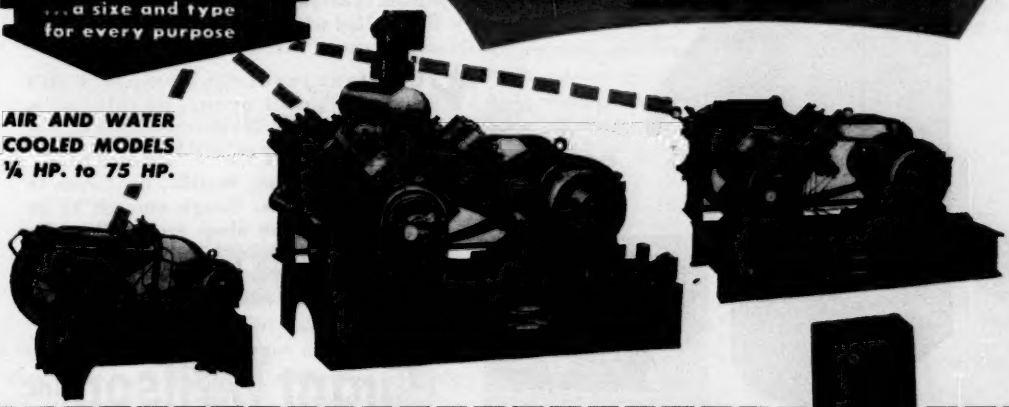
BRUNNER offers YOU not only a complete range of dependable equipment but a well known, highly respected organization working hand in glove *for* you toward the satisfying and profitable fulfillment of your contracts.

BRUNNER MANUFACTURING COMPANY, UTICA 1, N. Y., U. S. A.

Write or phone us for a factory representative who can talk your language, from preparing bids to making the installation. No obligation.

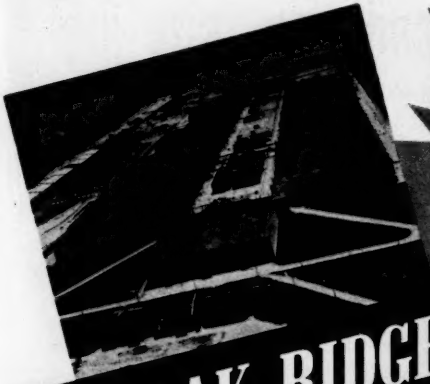
REFRIGERATION CONDENSING UNITS
...a size and type for every purpose

AIR AND WATER COOLED MODELS
¼ HP. to 75 HP.



BRUNNER
SINCE 1906

AIR CONDITIONING
Self Contained Units in 4 sizes: 3-5-7½ and 10 HP.
Remote Installation Types from 3 to 75 HP.



Another of the world's great engineering projects

The OAK RIDGE Atomic Energy Plant

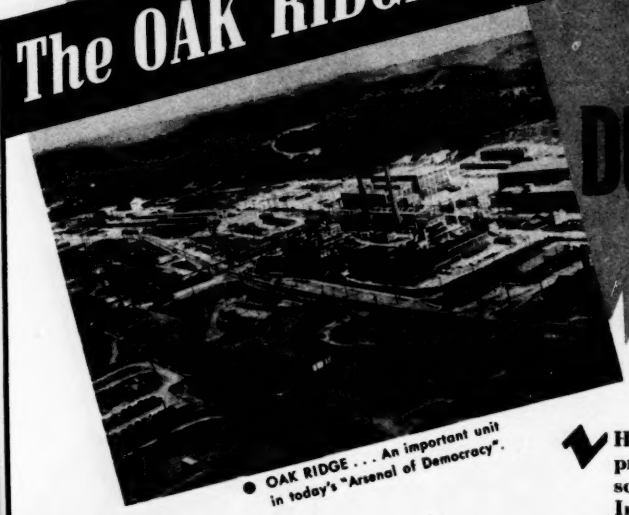
uses

Grant Wilson

ASBESTOS PROTECTED

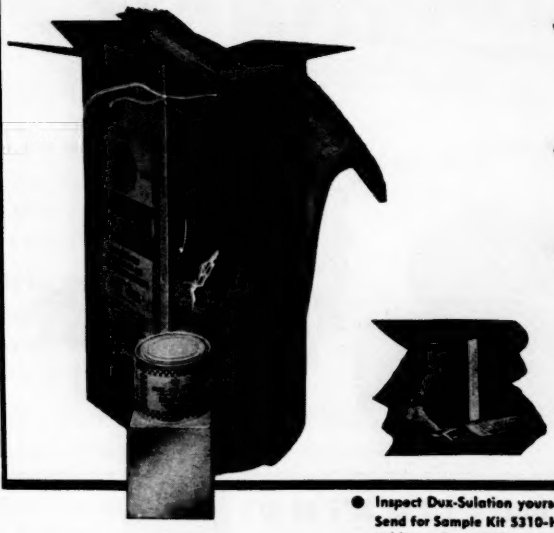
DUX-SULATION

for peak efficiency in duct insulation



● OAK RIDGE . . . An important unit in today's "Arsenal of Democracy".

- **High thermal and acoustical insulating properties . . . K factor of .27 BTU and sound absorption approximately 61%. Integral, woven asbestos membrane.**
- **Easy to handle, easy to install *correctly*, can't be crushed or cracked, springs back to original thickness if compressed. Supplied with special glue and tape, no "fasteners" needed.**
- **Constant insulating values. Can't "powder", shift or sift; no thin spots, even at corners. No deterioration of any kind, no *change* of any kind.**
- **Perfect adhesion, flexible, conforms to uneven surfaces. Tough enough to be installed in the shop and still withstand all necessary handling. Not just "adapted" for duct work, but specifically engineered for duct application ONLY!**



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ASBESTOS AND INSULATING MATERIALS

● Inspect Dux-Sulation yourself.
Send for Sample Kit 5310-HV today.
Address: Grant Wilson, Inc., Board of Trade Bldg., Chicago 4, Ill.

IN NEW YORK CITY: Air Conditioning Utilities Co., 8 West 40th Street, New York 18, N. Y., LOngacre 3-4280.
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What's Your HEATING PROBLEM?

Young "SH" Unit Heater

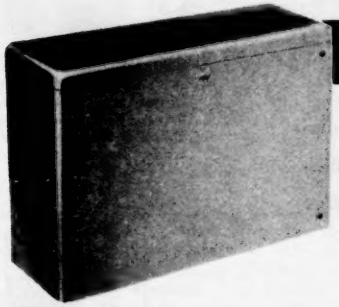
COLD SPOTS?

A favorite for general space heating and eliminating "cold spots" in large areas is the Young Type "SH" horizontal discharge unit heater. These non-ferrous-core units deliver maximum heat transfer . . . use quiet and efficient fans. Available in 14 sizes, with capacities ranging from 19,000 to 325,000 Btu per hour.

Young "Vertiflow" Unit Heater

EXTRA HIGH CEILINGS?

Patented "Vertiflow" design offers a rugged, compact, highly efficient unit with low hp requirement. Its exclusive motor "ventilation" feature eliminates burn-outs from core heat. Seven sizes range from 52,600 to 552,000 Btu per hour, and cover larger areas quicker, with fewer units. Diffusers, nozzles, and Anemostats provide any heat pattern desired.



Young Cabinet Unit Heater

DRAFTY AREAS?

Here's the ideal heating unit for lobbies, vestibules, auditoriums, etc. . . . wherever concentrated heating capacities are required and a compact, attractive exterior design is necessary. They are available in 3 sizes of each of 3 styles offering heating capacities ranging from 26,250 to 115,000 Btu per hour.

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Heat Transfer Products for Automotive and Industrial Applications.

Young Quality

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Heating, Cooling, Air Conditioning Products for Home and Industry.

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Dept. 521-K, RACINE, WISCONSIN

Factories at Racine, Wisconsin and Mattoon, Illinois

Sales and Engineering Representatives in All Principal Cities

THIS COUPON BRINGS FULL DETAILS ON THREE SOLUTIONS TO HEATING DIFFICULTIES

YOUNG RADIATOR CO.

DEPT 521-K,

RACINE, WIS.

Rush me information on the following Young Unit Heaters:

☐ "SH" ☐ "Vertiflow" ☐ Cabinet

Name_____

Company_____

Address_____

City_____ Zone____ State_____

SAFEWAY chooses the BEST WAY

to Comfort-Condition its Newest Supermarket . . .

See Our Exhibit at MAPP PIER - Chicago
7th ANNUAL INDUSTRY
REFRIGERATION AND AIR CONDITIONING EXPOSITION

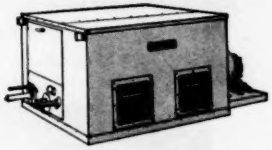
Latest addition to the Safeway Store chain—one of Washington, D. C.'s most modern (and comfortable) shopping centers.

Marlo Cooling Equipment

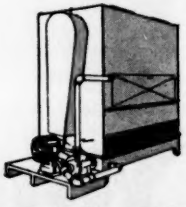
This ultra-modern Safeway Store in Washington, D. C., has selected Marlo equipment to meet its cooling needs . . . and to assure complete customer comfort.

With good reason, too! . . . Since Marlo cooling equipment has already proved its superior quality in efficiency, economy and consistent performance *in 24 other Safeway Store installations.*

Write for information on the complete Marlo line.



AIR CONDITIONING UNITS—one of two such units for supplying the Safeway's entire shopping area with complete summer-winter functions: cooling, heating, ventilating, filtering.



EVAPORATIVE CONDENSER — 25 ton capacity . . . designed to assure maximum water savings . . . quiet, durable, compact for long-life service.

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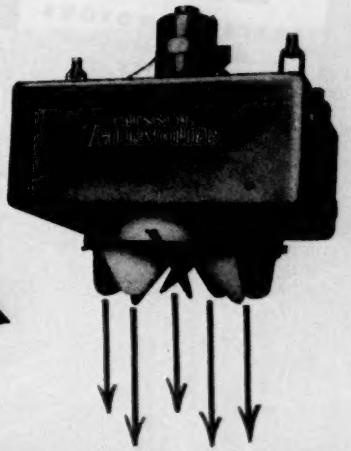
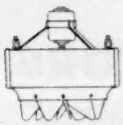
DOWNRIGHT
better performance

Vertical Delivery
THERMOLIER
Unit Heaters . . .

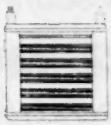


RIGHT DOWN
where maximum heat is desired...

4 MODELS . . . . . 18 SIZES



Vertical Delivery



Horizontal Delivery

Textile Model

Velocity Nozzle

A thermostatic trap, the simplest and least expensive of all traps, is practical because of Thermolier's exclusive cooling leg.

Maximum capacity assured, annoying destructive water hammer eliminated — by built-in pitch of tubes and internal cooling leg which assure continuous drainage of condensate.

Damaging strains caused by expansion and contraction eliminated by "U" type expansion tubes.

Safety and durability assured with leak-proof tube-to-header construction.

Five other important construction features. Write for Thermolier Catalog.

in warehouses, plants and other hard-to-heat buildings

HEATING COMFORT AND ECONOMY. Heat is forced down to the working level . . . not banked uselessly at the ceiling level. Thermoliers provide quick heating from a cold start. Desired room temperatures are easily maintained within a close range.

ADAPTABILITY TO EQUIPMENT AND FLOOR LAYOUT. The units and the simple piping are overhead where they do not interfere with arrangement of operating machinery or equipment and do not take up valuable floor or wall space. Units are easily relocated at any time to meet changes in plant layout or heating requirements.

LOW FIRST COST. Thermoliers are so efficient and so compact that their heating capacity is often equivalent to the capacity of cast iron radiation or pipe coils of twice the cost.

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WHENEVER PIPING IS INVOLVED

Grinnell Company Inc., Providence 1, Rhode Island • Sales Offices and Warehouses in Principal Cities

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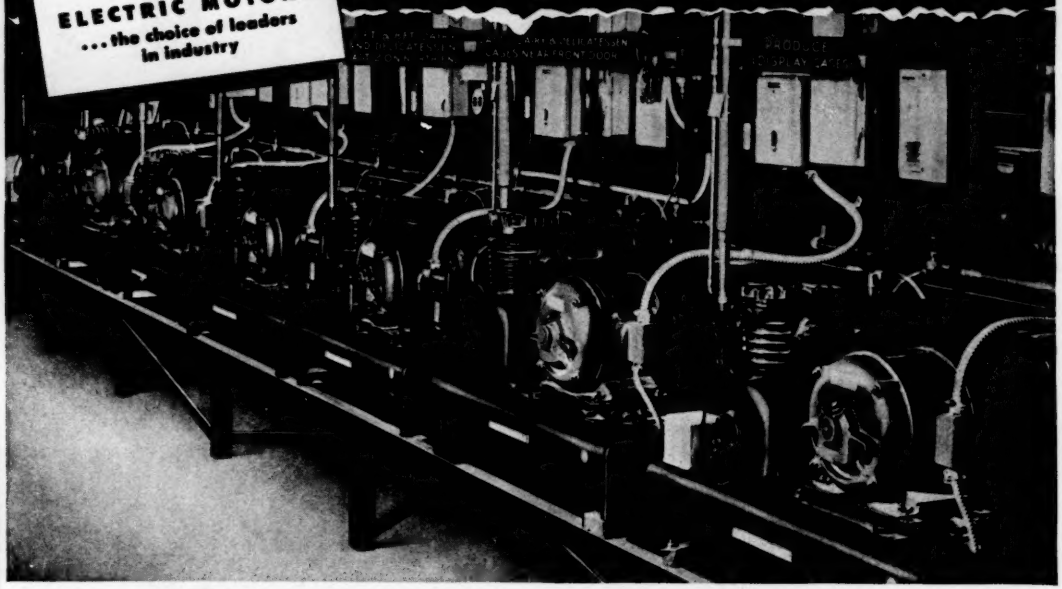
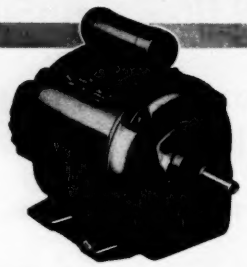
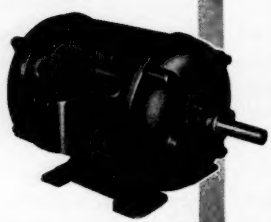
Wagner
ELECTRIC MOTORS
... the choice of leaders in industry

it *pays* to be particular about your choice of motors





Wagner Capacitor-Start Motors—⅛ to 3 hp.



Wagner Repulsion-Start Induction Motors—⅛ to 15 hp.

you can count on

Wagner MOTORS

to furnish dependable power for your products

"A good motor is one I seldom hear about—and a good motor manufacturer is one who provides prompt honest service for the few motors I do hear about." These words, from the Service Manager of one of the large manufacturers who use thousands of Wagner Motors each year as standard equipment for their products, pretty well sum up the reasons why it will pay *you* to standardize on Wagner Motors.

You get motors that give uniform performance with exceptionally little trouble . . . you get well-known motors that add a real selling point to your product . . . and you get the advantage of a large nationwide service organization to promptly and efficiently repair the very few motors that require attention.

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AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

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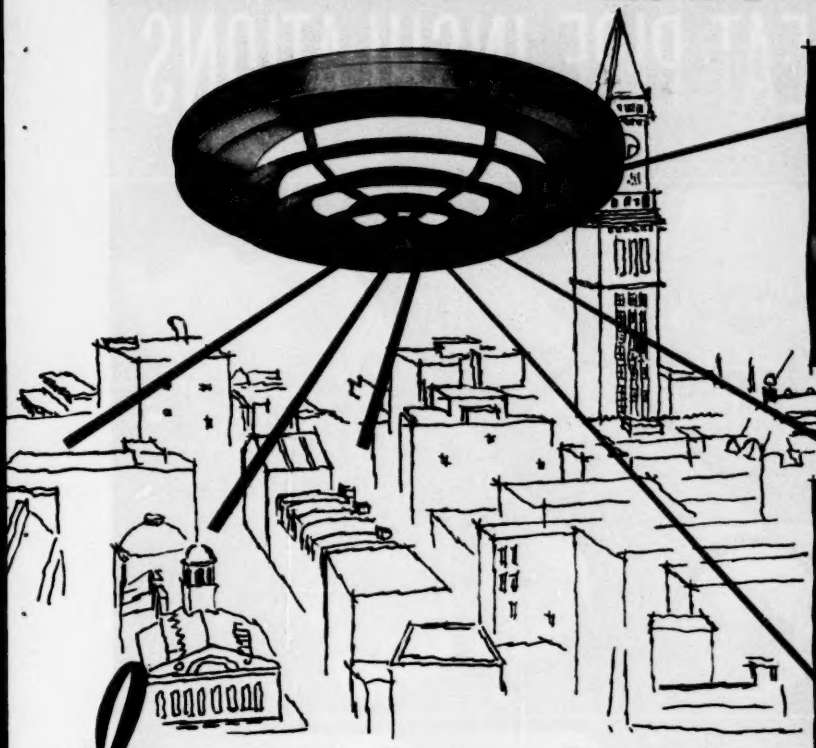
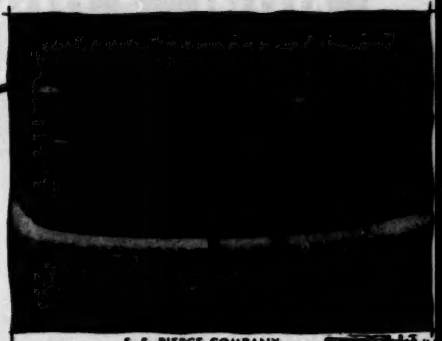
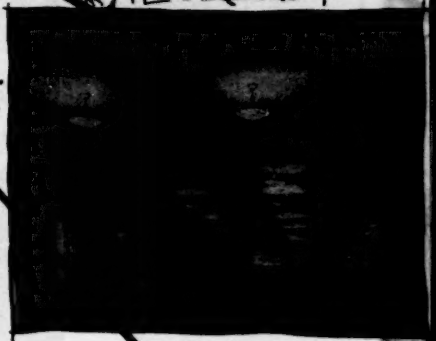




S. S. PIERCE COMPANY



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In the shadow of Bunker Hill . . . Old North Church . . . and the many other historic landmarks here . . . busy Boston enjoys the comfort and convenience of modern air conditioning in its up-to-date commercial, industrial and institutional buildings.

As is the case in other cities from coast to coast, important air conditioning jobs in Boston are Aerofuse Diffuser jobs. Selected on the basis of efficient, dependable performance . . . and smart styling that blends architecturally with modern interiors . . . Aerofuse Diffusers meet the most exacting requirements at the *vital point of air delivery*, the point at which the success of an air conditioning installation is measured.

There's a complete Aerofuse line . . . a type and style to meet every job specification. For complete details, size selection information and engineering data, write for Catalog 104.

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TUTTLE & BAILEY inc

NEW BRITAIN, CONNECTICUT

ENGINEERED PRODUCTS FOR HEATING, AIR CONDITIONING AND VENTILATING

NOW 3 GREAT PIPE INSULATIONS

Amocel

joins Unibestos in the UNARCO line of asbestos pipe insulations

...up to 650°F.

Answering the demand for a jacketed pipe insulation for use in the lower heat ranges, UNARCO now offers Amocel — for temperatures up to 650°F. Like Unibestos, Amocel is made of Amosite asbestos fibers bonded with an inorganic binder. For pipe sizes from ½" through 12", in Standard thickness only. Light in weight. Highly efficient. Durable.

UNIBESTOS
...up to 750°F.

UNIBESTOS
...up to 1200°F.

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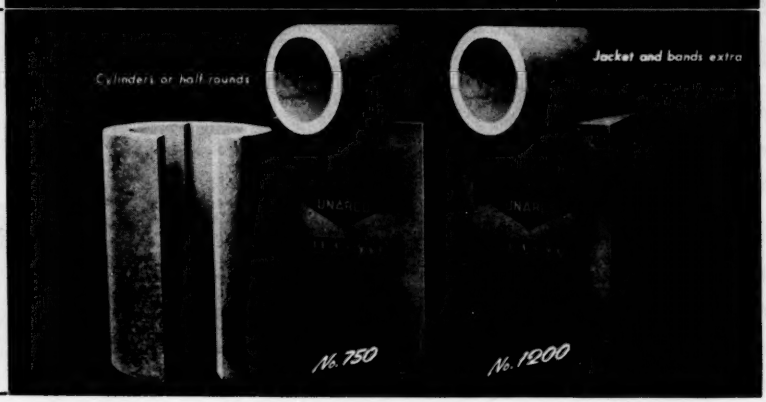

We want you to have our Catalog — It gives you complete information on Amocel and Unibestos Pipe Insulations; Unibestos Insulating Block; Cements and Finishes; Flexible Insulations; Metal Mesh Blankets; Tailored-to-Fit Insulations; Asbestos Packings and Gaskets; Asbestos Textile Products . . . Just drop us a line today requesting that we send you UNARCO Catalog No. 76-109.

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...and Save money doing it!

Make DOREX AIR RECOVERY part of your air conditioning or heating plans

An air conditioning system works like this: fresh air is brought in from the outside, heated or cooled according to season, and circulated throughout the conditioned area. This heating and/or cooling is what costs money. So, if you can reduce the amount of outside air you have to take in — down go your expenses.

Dorex Air Recovery reduces, *by as much as two-thirds*, the amount of fresh outside air required. You "make your own" fresh air by passing *used* air through the remarkable Dorex C Cell — wherein beds of activated carbon remove all odorous and gaseous impurities, renewing air freshness.

Thus, with Dorex Air Recovery you have far less new air to heat or cool. Less heating or cooling capacity is needed — saving both critical materials and money. Experience, based on more than 7,000 Dorex installations over the past 20 years, indicates that every $100 invested in Dorex Air Recovery should return a $400 saving in initial equipment, and every $1 spent for Dorex maintenance should return a $4 saving in operating costs.

It will certainly pay you to investigate Dorex Air Recovery.

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Air Recovery

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Air Diffusion • Air Purification • Air Recovery

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Marsh valves and traps throughout... IN CHICAGO'S MODERN FLORSHEIM PLANT

HEDRICH-BLESSING STUDIO

This new plant of the Florsheim Shoe Co. has been described as one of Chicago's recent architectural masterpieces. Only the best was good enough for this model establishment . . . and that is why Marsh Traps and Valves were used throughout.

The heating system contains a large number of Marsh Float and Thermostatic Traps of indicated types, and radiation is equipped with hundreds of Marsh Packless Radiator Valves and Radiator Traps.

Ask for facts about Marsh valves, traps and venting devices —time tested equipment, preferred by the most discriminating heating men.

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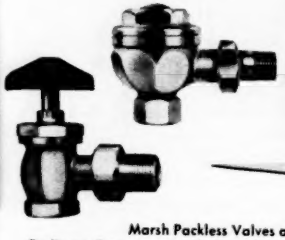
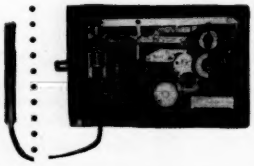


Marsh Packless Valves and Radiator Traps are used throughout in the Florsheim plant.

Marsh No. 12 Float and Thermostatic Trap — typical of many float and thermostatic traps, used in the Florsheim plant, which include Marsh No. 8 and No. 14 Traps.



MARSH *Tri-Trol* . . . heat control in step with the weather . . . EFFECTS BIG SAVINGS

More and more owners of multiple occupancy buildings — from two apartments up to skyscrapers — are finding Marsh Tri-trol the answer to providing maximum comfort at minimum fuel cost. Tri-trol is a simple, low cost, easily installed regulator that pays its way many times over in savings. Ask for details.

MARSH HEATING EQUIPMENT CO. Sales affiliate of Jas. C. Marsh Corp., Dept. U, Skokie, Ill.

MARSH

Heating Specialties SINCE 1865

JOY AXIVANE* FANS

WITH JOY AXIVANE Fans, you profit by the greater efficiency, quieter and smoother operation, and lower power consumption of their vaneaxial design. You save on installation, too. These light, compact, in-line fans mount directly in the air duct—saving space and time, making foundations, guards, etc. unnecessary. What's more, the important adjustable-blade feature of JOY Fans gives you extra flexibility—permits easy adjustment on the job to suit new conditions or compensate for faulty duct work. ● Let us show you how to get *best* ventilating results!

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Consult a Joy Engineer

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W&D I 2350

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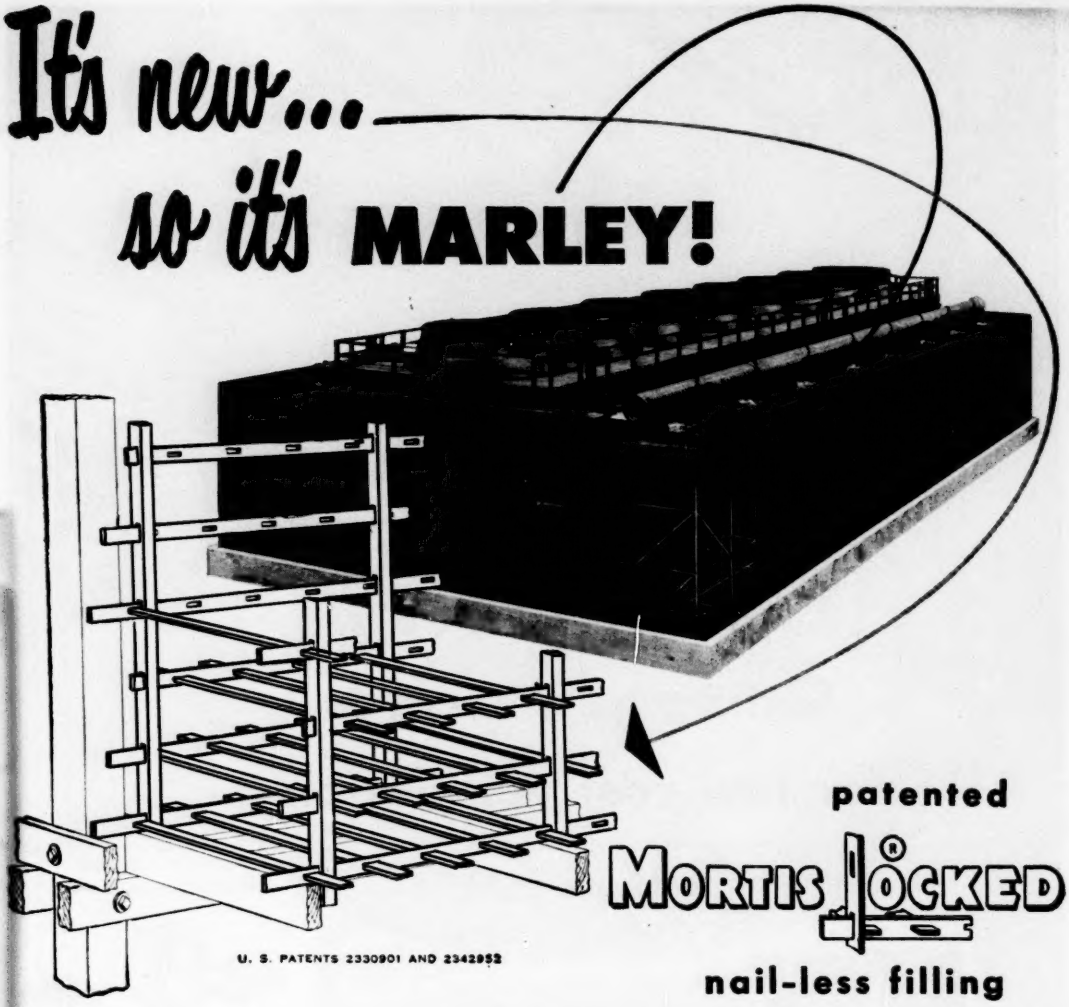
It's new... so it's MARLEY!



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nail-less filling

. . . THE COOLING TOWER FILLING THAT BREATHES

. . . has long been an important factor in making Marley Double-Flow the world's leading water cooling tower. Now it's redesigned for even greater ruggedness, more long-lasting stability. *And it retains its ability to expand and contract with every variation of temperature and moisture.*

Design simplicity is the keynote of MortisLocked filling . . . no nails, bolts or spacer blocks are needed. There are no parts to rust, corrode or fall out. Bulletin ML-51 graphically portrays MortisLocked superiority . . . write for it now.

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MARLEY

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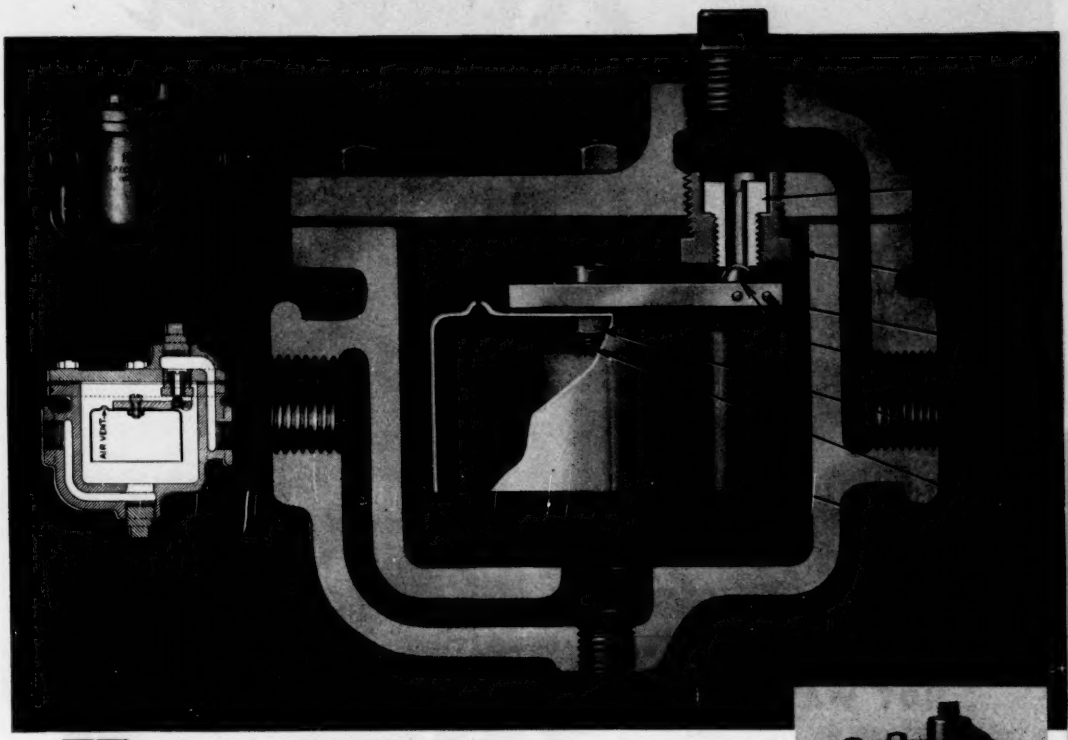
NOTED FOR *Efficiency...*

This simple mechanism is *Easy* to install *Easy* to service



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INVERTED *BUCKET TRAPS*

FOR STEAM SERVICE

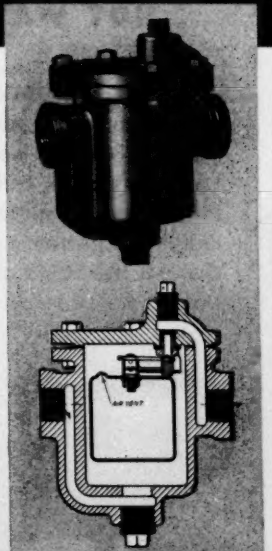
Hoffman Bucket Traps operate intermittently and are particularly applicable to draining condensate and air from steam lines or equipment where large quantities of air and condensate must be discharged. They are easily inspected, cleaned and serviced by merely removing the cover assembly.

Straight-through pipe connections permit close-to-floor installation.

All working parts are connected to the bonnet and are removable with it for service without breaking pipe connections.

These are features of design appreciated by the maintenance man in saving man-hours when man-power is costly and scarce.

Hoffman Bucket Traps are adjustable to a wide choice of pressures—simply by changing valve seats. Send today for full information, no obligation.



SERIES 600A TRAP
Pressure Range 0 to 125 Lbs. Capacity From 600 to 1150 Lbs. Condensate Per Hour

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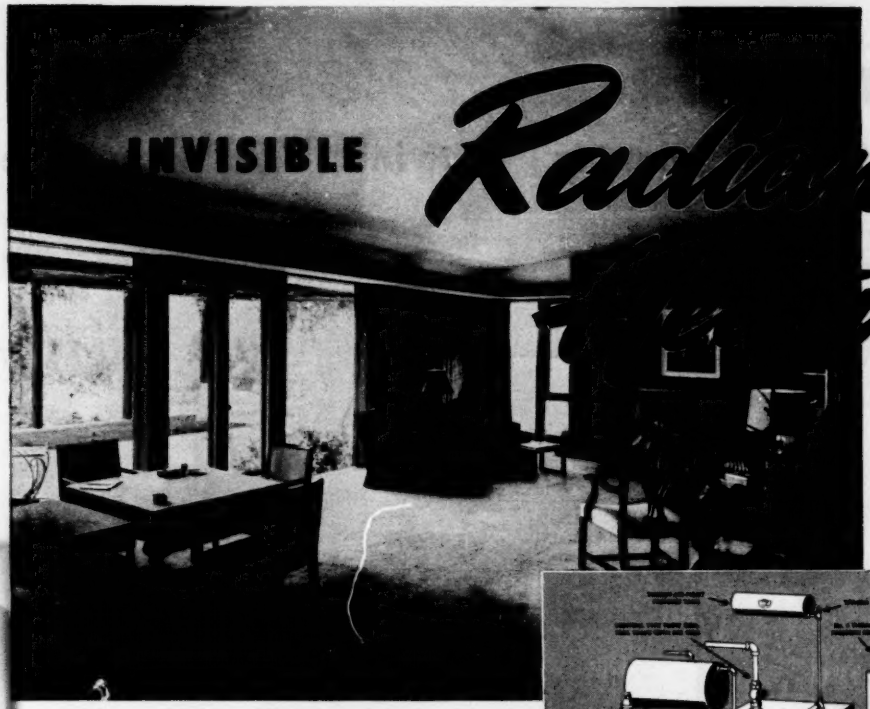
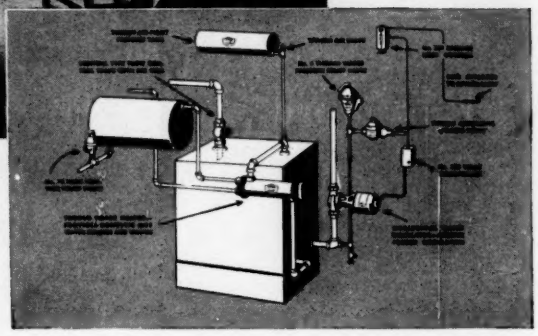
Makers of Valves, Traps, Vacuum and Condensation Pumps, Forced Hot Water Heating Systems.
Sold by leading wholesalers of Heating and Plumbing Equipment.



forced circulating

THRUSH FLOW CONTROL HOT WATER HEAT



THRUSH hot water heating system is flexible. With forced circulation and completely automatic control you can install any type of modern heating your customers desire and be sure of complete satisfaction. Heat from radiant coils hidden in ceiling or floor, radiant baseboards or convectors, with Thrush Flow Control System provide perfect comfort without overheating, automatically compensating for weather changes. Zoning is simple and inexpensive. Get all the facts on profitable Thrush equipment now. See your wholesaler today or write Dept. D-10

THRUSH HORIZONTAL WATER CIRCULATOR

THRUSH

H. A. THRUSH & COMPANY

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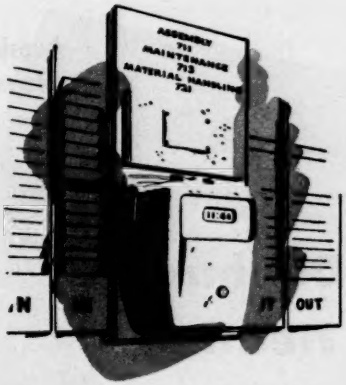

A BOILER THAT PUNCHES THE TIME CLOCK

Yes — a Cleaver-Brooks Boiler "Punches In" to meet a heavy steam demand — "Punches Out" during low load periods.

Steam costs can eat deeply into profits when steam loads fluctuate — or are intermittent. With a Cleaver-Brooks boiler you are equipped for heavy or light . . . steady or variable loads, operating at full 80 per cent efficiency over the entire working range of the boiler.

You are assured of fuel economy through high heat transfer. *All* Cleaver-Brooks boilers are of the four pass design and the maximum useable heat is absorbed in these four passes before the combustion gases leave the boiler.

Remember the name Cleaver-Brooks if you are considering a change in your present boiler plant. Think about flexibility and get the complete facts about Cleaver-Brooks Self-Contained Boilers — standard models in 15 to 500 HP, 15 to 250 psi, oil, gas, combination oil and gas fired — 80 per cent efficiency.

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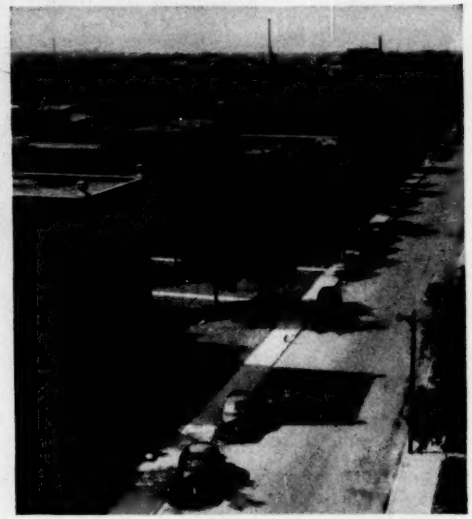
Cleaver-Brooks
STEAM BOILERS
the first and finest of their class

Write for the latest graphically illustrated Cleaver-Brooks Boiler Catalog. It tells and shows how you can save money with a Cleaver-Brooks Boiler installation.

housing projects ↓ Julia C. Lathrop Homes, Chicago, Ill. Architectural Director: Robert S. Degolyer, Chicago, Ill.



How Dunham Vari-Vac Heating

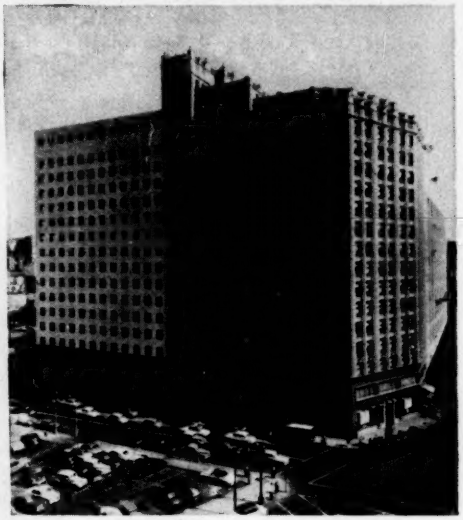
Cuts fuel costs up to 40%

Your customers can save up to 40% on fuel bills with Dunham Vari-Vac* Differential Heating. Why? Because this high vacuum, precision temperature control system *uses less steam* to heat any building . . . regardless of its size, type, age, or location.

On mild days, for example, Dunham Vari-Vac *expands* smaller quantities of "cool" subatmospheric steam. And on cold days, no matter how rapidly outside temperatures change, Vari-Vac automatically delivers the *exact* amount of heat needed. No more. No less.

Choice of systems. 7 different Vari-Vac systems are available, varying only in the degree of control desired. For complete information, see your Dunham Sales Engineer . . . or write for Bulletin 2101-16.

**Variable Vacuum.*



office buildings ↑ Medical-Dental Building, Seattle, Washington Architect: W. Henry Fey, Seattle, Washington

Send for Free Booklet 2101-16

Tells all you will need to know about this amazing system—how it operates, how it may be fitted exactly to your customers' needs. Write for your copy.

DUNHAM

heating systems and equipment

C. A. DUNHAM COMPANY
400 W. Madison Street, Chicago 6, Illinois
In Canada: C. A. Dunham Co., Ltd., Toronto
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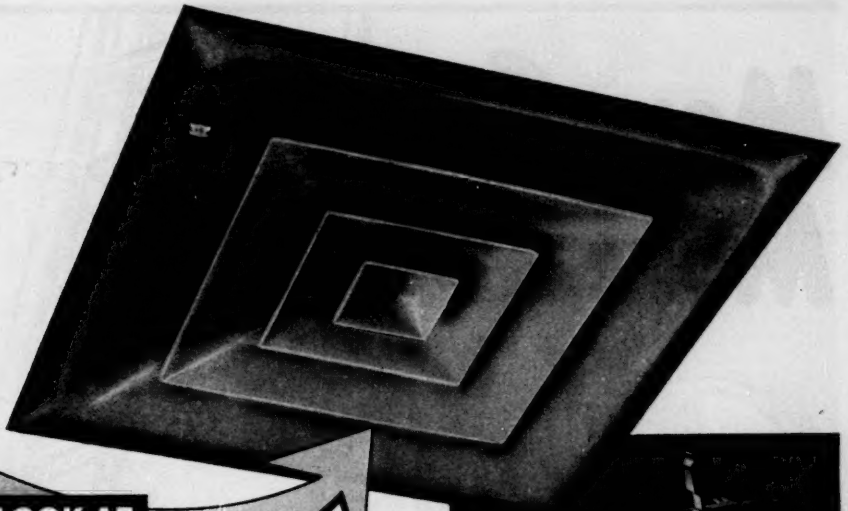
Radiation • Unit Heaters • Pumps • Specialties

Instantaneous response to outside weather changes.

Convenience of centralized operation

Automatic compensation for heat loss.

Heat supply and demand perfectly balanced.



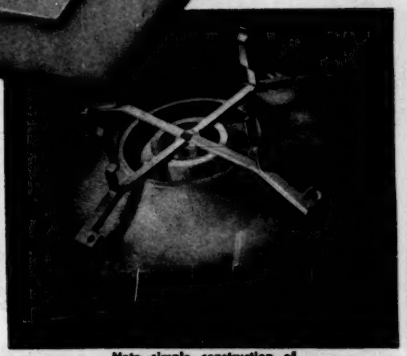
easy TO LOOK AT

easy TO INSTALL

SQUARE

Anemostat Air Diffusers

A glance at either the Type E Anemostat Air Diffuser which fits perfectly into acoustic tile ceiling construction, or the Type E-1 which is flanged for standard ceiling installations and you'll agree that these diffusers lead the beauty parade. Moreover, these outlets give you not only the benefits of Anemostat's superior performance but they are a *snap* to install because the inner assembly does just that—it *snaps* into place. No special tools are required and access to the furred space above the ceiling is unnecessary. Just *snap* out the inner assembly and you have the full neck opening to work in. Then fasten the outer member to the duct, *snap* on the equalizing deflector, *snap* the unit together and you're done. Anemostat Square Air Diffusers are easy to look at, easy to assemble and easy to install. They are easy to obtain as well. We have Anemostat Square Air Diffusers "on the shelf" in sizes to meet every need.



Note simple construction of inner assembly

Snap the Equalizing Deflector on the spider

Just snap the inner assembly into the outer member

AC-1271

ANEMOSTAT®

DRAFTLESS *Aspirating* **AIR DIFFUSERS**

ANEMOSTAT CORPORATION OF AMERICA

10 EAST 39th STREET, NEW YORK 16, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

"No air conditioning system is better than its air distribution"

More Scrap! More Steel!!

AMERICA expects the steel industry to produce more steel this year. More steel requires additional scrap. Steelmakers need the help of all steel users to get every possible extra pound of scrap to meet the nation's call for more steel production. We urge you to do your part. Turn in your scrap through your regular channels.

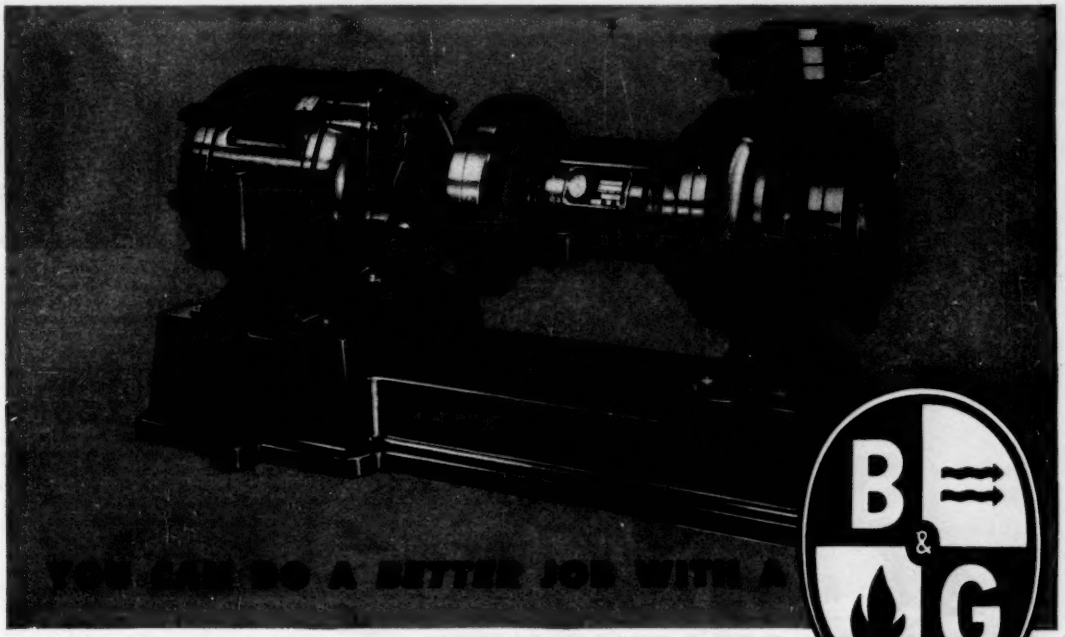
YOUR SCRAP IS NEEDED — YOUNGSTOWN

The Youngstown Sheet and Tube Company

General Offices—Youngstown 1, Ohio
Export Offices—500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment!



For your larger forced hot water heating installations, *this is the pump!* It's the big brother of the famous B & G Booster, with all of the basic features of this biggest-selling circulator. The water-tight seal, for example, polished steel shaft with integral thrust collar, extra-long bronze bearings and oil lubrication. Like the Booster, it can be serviced without removing from the line.

Obviously, the B & G Universal is *not* just another centrifugal pump. It is engineered in every detail—including a specially designed motor—to assure that all-important quality of *quietness!*

With heads to 78 feet and capacities to 1,200 GPM, the B & G Universal Pump is suitable for application in garden apartments, industrial plants, institutions and commercial buildings. You can install it with complete confidence in its efficiency and all-around dependability.

Complete information is given in the B & G Catalog —send for your copy.

BELL & GOSSETT
COMPANY

Dept. CF-4, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada

FORCED HOT WATER HEATING EQUIPMENT . . . CENTRIFUGAL PUMPS . . . WATER HEATERS . . . HEAT EXCHANGERS . . . REFRIGERATION EQUIPMENT

Hydro-Flo
UNIVERSAL PUMP

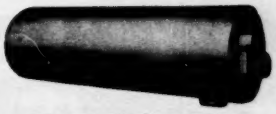
An application of B&G Universal Pumps in a plant where hot water is used for space heating, service water heating and process work.

B & G Hydro-Flo Products protect your most valuable asset — customer satisfaction

B & G FLO-CONTROL VALVE

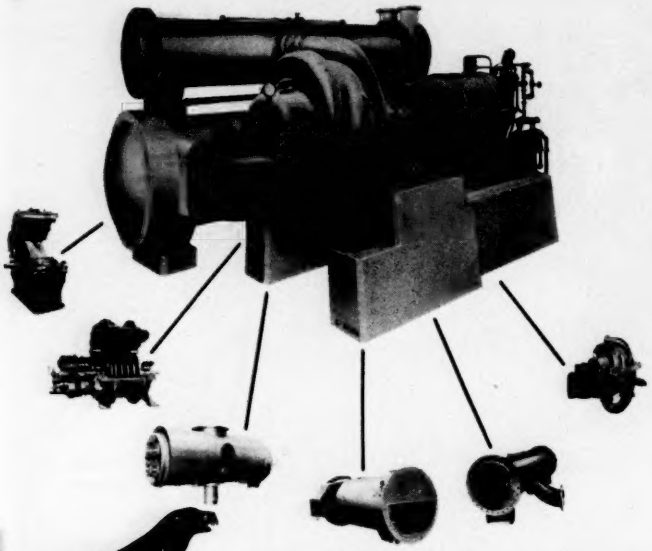
B & G MONOFLO FITTING

B & G RELIEF VALVE (ASME)



B & G INDIRECT WATER HEATER

*REG. U. S. PAT. OFF.



Where do you get

UNDIVIDED RESPONSIBILITY

in an installation of centrifugal refrigeration?

Worthington will "wrap up a package".

Unlike other manufacturers of air conditioning and refrigeration equipment, Worthington *makes*—not just assembles—all the major components for each installation.

Compressor, condenser, cooler and such drive equipment as steam turbines, steam condensers, motors, and step-up gears—are all made in Worthington's own plant—each carefully designed for balanced operation with its companion components.

So the builder and owner can place full responsibility on the one supplier —Worthington.

Worthington centrifugal systems are used with most refrigerants and for any process—chilling water, brine, chemicals, lubricating oils—for temperatures as low as minus 160 F, capacities from 150 to 2600 tons.

A typical Worthington compressor feature is the arrangement of the volute passages and impellers to counterbalance the radial and axial thrusts, respectively, in the various stages.

Write for Bulletin C-1100-B14 on Worthington centrifugal refrigeration.

Worthington room conditioners for both heating and cooling are built to operate with chilled water or direct expansion cooling, capacities from 350 to 600 cfm for under-window installation.

PACKAGE UNITS SELECTED TO COOL HUGE OFFICE BUILDING

This is an excellent example of how Worthington's complete line makes it possible to select exactly right equipment.

The new office building at 488 Madison Avenue, New York—home of many famous magazines and large industrial firms—is air conditioned primarily by package units, assisted by a Freon-12 reciprocating system with chilled water and steam coils.

Purpose of using package units in a big building like this is to provide for a variety of conditions imposed by both the building and the type of tenants: air conditioning needed only on top floors during certain seasons, difference in sun load on various sections, certain tenants working late hours but only with skeleton forces.

Second through 20th floors are handled by 38 Worthington 20 and 25 ton Package Air Conditioners, two per floor. Basement, first floor and top three floors are handled by two Worthington 75-ton Freon-12 compressors complete with condensers, pumps, water coolers and five central station units with chilled water and steam coils. Total capacity is 1050 tons.

Builders and owners: Uris Bros. Consulting engineer: Henry Oehrig. Air conditioning contractor: Raisler Corp. Architects: Emery Roth & Sons. All of New York.

RICE HOTEL MULTIPLIES COMFORT-COOLING WITHOUT REQUIRING MORE ROOM

Last year, Houston's Rice Hotel completed air conditioning its entire building, including a thousand guest rooms, dining rooms and meeting rooms, by installing three Worthington 600-ton centrifugal chilled water systems.

This equipment, utilizing Freon-11, replaced ammonia refrigeration equipment having a capacity of 350 tons, yet occupies no more space than formerly.

Worthington equipment was selected primarily because Worthington could provide 100% equipment of its own make. The compressors are driven by Worthington steam turbines and steam condensers.

Engineer: Reg. F. Taylor. Mechanical Contractor: Charles G. Heyne & Co. Architect: Kenneth Franzheim. All of Houston.

WORTHINGTON

AIR CONDITIONING AND REFRIGERATION

INVESTIGATE

MORE WORTH WITH WORTHINGTON

Consult Classified Telephone Directory for nearest Worthington distributor. Worthington Pump and Machinery Corporation, Air Conditioning and Refrigeration Division, Harrison, N. J., specialists in air conditioning and refrigeration for more than 50 years. A1.2

Bundyweld Tubing . . . plays double role in better radiant heating

Handles better at your building site, **Performs** better in your systems . . .

Because Bundyweld is better tubing . . . the only tubing that's double-walled from a single strip, with a patented beveled edge. Copper-brazed through 360° of contact, its walls are safe, solid, strong.

Rugged Bundyweld arrives at your building site (one end expanded if specified) ready to ride right through fabrication steps. One man bends dead-soft Bundyweld on a simple fixture, joins the formed, rigid grids in leakproof union by soft or hard soldering. Just two men position them. There's never a worry about dents or structural collapse.

Performance in your systems is just as smooth. For Bundyweld is scale-free. Water flow stays clean, even, steady. Bundyweld's thinner wall radiates heat faster, more effectively, as well.

Check your *Sweet's Architectural File* for more information. Or write: ***Bundy Tubing Company, Detroit 14, Michigan.*** Whatever your needs, we'll do our best for you, with the understanding, of course, that defense orders must come first.

Bundyweld® Tubing

DOUBLE-WALLED FROM A SINGLE STRIP

WHY BUNDYWELD IS BETTER TUBING

Bundyweld starts as a single strip of basic metal, coated with a bonding metal. Then it's . . .

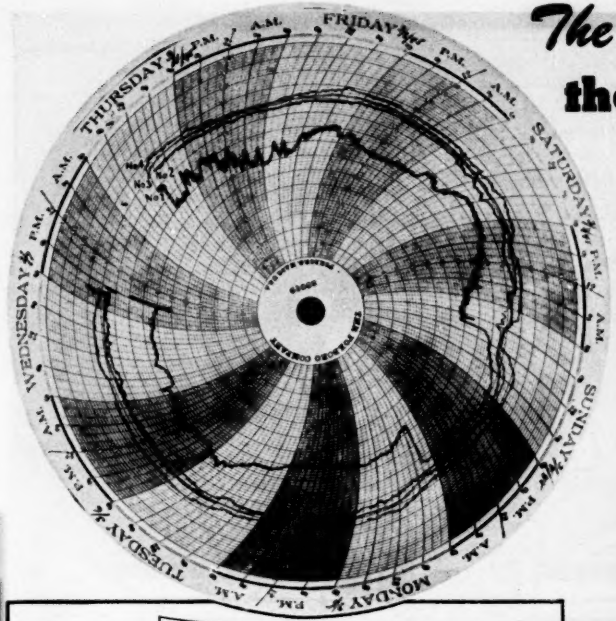
continuously rolled twice around lengthwise into a tube of uniform thickness, and

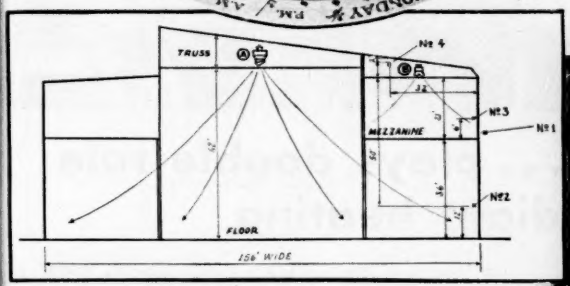
passed through a furnace. Bonding metal fuses with basic metal, presto—

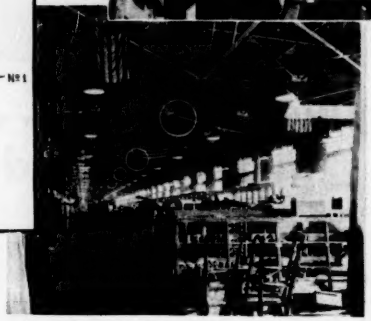
Bundyweld . . . double-walled and brazed through 360° of wall contact.

NOTE the exclusive patented Bundyweld beveled edge, which affords a smoother joint, absence of bead and less chance for any leakage.

The Story of the TEMPERATURE CHART







(Above) Main section of building showing 6 of the 10 large Wing Revolving Heaters 62' above the floor.

(Left) View on the mezzanine, showing the smaller Wing Revolving Heaters located 21' above the mezzanine floor.

REPLACING an expensive but inadequate heating system, Wing Revolving Unit Heaters completely solved a difficult heating problem in a shipbuilding plant. The building is 156' wide by 62' to the cross beams by 802' long. A mezzanine is 42' by 21' to the cross beams by 802' long.

Wing

REVOLVING UNIT HEATERS

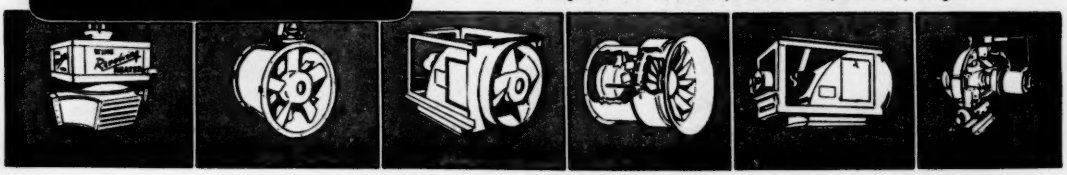
Ten Wing Revolving Unit Heaters with one-way revolving discharge outlets cover the section marked "A" on the diagram and shown in the upper photograph. Ten smaller Wing Revolving Unit Heaters with Design No. 8 revolving outlets cover the mezzanine shop marked "B" on the diagram and shown in the lower photograph. Fairly high working temperatures (75° F) were required and furnished. The chart from a recording thermometer, with bulbs located as shown, reveals graphically the even working temperatures, the relatively low ceiling temperatures and the fluctuating outdoor temperatures (32° to 75° F) over one week's time.

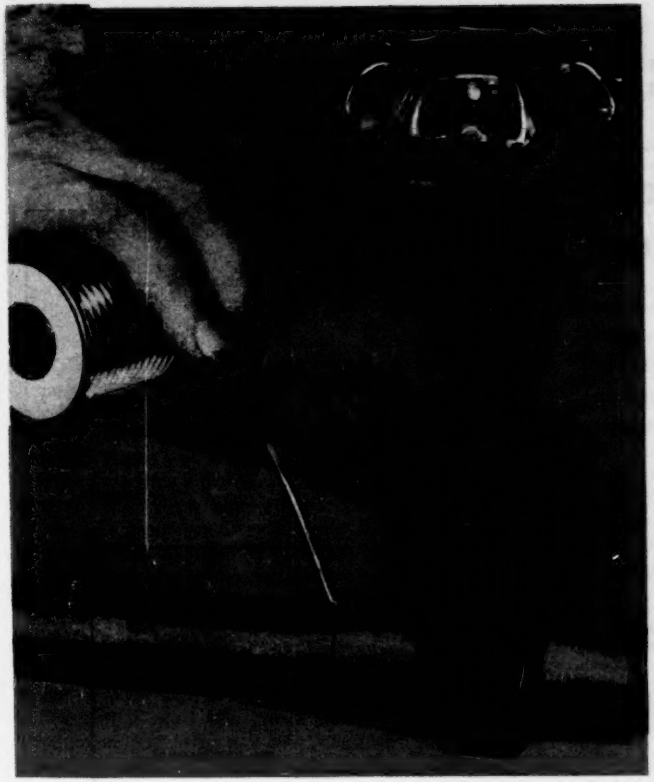
Write for further details and a copy of Bulletin HR-6

L. J. Wing Mfg. Co., 158 Vreeland Mills Rd., Linden, N. J.

Factories: Linden, N. J. and Montreal, Can.

In Europe: Etab. WANSON, Haren-Nord, Brussels, Belgium

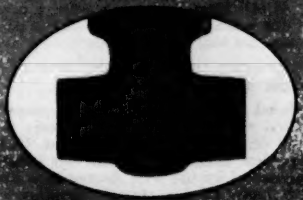




For

EASY INSTALLATION
POSITIVE CONTROL
LASTING ECONOMY
in copper line service

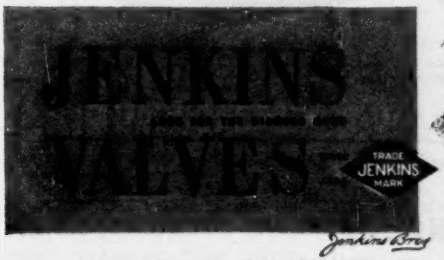
JENKINS *Solder-End* VALVES



To speed installation in copper lines, you want a valve with an accurate fit to tubing—a valve that will not distort under the intense heat of soldering. And, because flexible tubing does not afford the rigid support of standard pipe, you want a valve that will withstand unusual strains in operation.

To give you Solder End Valves that meet *every* test in the toughest service Jenkins valve specialists designed them with an extra measure of rugged endurance, along with the dimensional accuracy and operating efficiency you expect in all valves of Jenkins quality.

A new Folder, Form 198, describes the complete line of Jenkins Solder End Valves, shows construction details, and gives instructions for correct installation. Get your copy—see why so many economy-wise valve buyers specify *Jenkins*. Jenkins Bros., 100 Park Ave., New York 17. Jenkins Bros., Ltd., Montreal.



specify

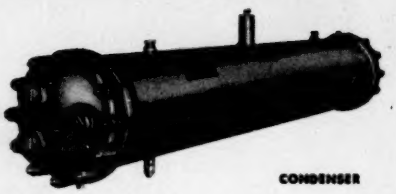
for an unbeatable combination

Acme

Acme can furnish the unbeatable combination for industrial liquid chilling. When you specify an Acme Dry-Ex liquid chiller, heat exchanger, or oil separator, you'll get a flexible combination with many years of low cost, trouble free service.

ACME CONDENSERS

Offered in Shell and Coil and Shell and Tube designs, the ACME line of condensers is very complete — more than 120 standard sizes are offered for use with Freon, plus seven sizes in Model SC Shell and Finned Coil, with twelve additional sizes in Model J Shell and Tube Condensers. Both are designed for Freon 12 or Freon 22 Refrigerant. ACME Condensers are inexpensive, have drainable coils, are easy to clean and are compact, sturdily built and extremely efficient.



CONDENSER

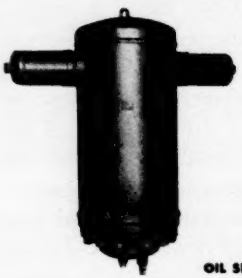
ACME HEAT EXCHANGERS

Available in 16 standard sizes, in capacities from ½ to 180 tons, ACME Heat Exchangers increase compressor capacity, prevent flash gas in liquid line, eliminate expansion valve vibration or chattering and offer true counter-flow operation. Model H has shell and coil construction. Also available in "U tube" bundle construction. ACME Heat Exchangers offer a practical solution when compressor capacity is on the border line for load requirements.

HEAT EXCHANGER

ACME OIL SEPARATORS

Are offered in a complete range of sizes, are economical and efficient to operate, easy to install and offer positive oil separation. Offered in a complete range of sizes, they are scientifically engineered for use with Ammonia or Freon. Series F Units have a central mounting strap and may be mounted directly on the Compressor base. Series FK and AK Models have a support bracket welded to the top.



OIL SEPARATOR

ACME DRY-EX* WATER COOLERS

Designed to meet an extensive variety of either commercial or industrial applications, ACME DRY-EX Water Coolers are offered in more than 700 combinations of refrigerant heads baffle spacings and tube lengths. ACME Straight through tube construction permits the refrigerant circuit to be increased twice as frequently as in the "U tube" design. Baffles have a tighter fit with the shell and with the tube, and straight through tubes can easily and economically be replaced in the field.

WATER COOLER

ACME ALSO MANUFACTURES: *Freon Condensers—Ammonia Condensers—Blo-Cold* Industrial Unit Coolers — Evaporative Condensers — Liquid Receivers — Pipe Coils — Shell and Tube Condensers — Shell and Coil Condensers — Heat Exchangers — Flow-Cold* Liquid Chillers.*

ACME PRODUCTS

**Acme INDUSTRIES, INC., JACKSON, MICHIGAN, U.S.A.*

CONTINUOUSLY SERVING THE REFRIGERATION INDUSTRY SINCE 1910

*Trade Mark

Washington News

LORING F. OVERMAN

THE defense program has now reached the period of painful dislocation.

According to Manly Fleischmann, Defense Production Administrator, who is in a position to know what to expect, "In the months ahead, we are all going to feel the rough edge of the defense program."

As of the first of this month (October) the national economy began operating on a closed-end CMP plan for the first time since World War II. With military agencies and defense-supporting industries at the head of the line, every industry needing steel, copper, and aluminum was required to bow respectfully to Washington before proceeding with its production schedules. For the moment, those at the far end of the line were not sent away empty-handed. No production activity has yet been cut off completely from supplies of scarce materials. Many have been told to supplement curtailed supplies with substitute material.

"Recently," said Mr. Fleischmann, "the National Production Authority had the unpleasant duty of announcing how steel, copper and aluminum—the basic materials of our entire economy—will have to be distributed during the last three months of this year. Those figures were, I know, a shock to anyone who did not yet understand that preparing to defend our country is not a matter than can be taken lightly or with half-way measures.

"The figures showed that to assure materials for production of defense equipment, the production of the broad category of civilian goods must give way to guns and planes and ships, with resulting sharp dislocations throughout the economy. These shifts threaten a substantial loss of profits for many firms, and severe personal loss for all of us as individuals."

Super Priority

Next to making CMP a closed-end affair, one of the most significant trends in Washington is the pressure toward development of a multiband priority system. This pressure is regarded by some as frightening, for they see in it the beginning of arbitrary control of production. The chronology is as follows:

(1) During the first few months of the current defense program, a single-band priority system was sufficient to channel deliveries to the military.

(2) Single-band ratings were then issued in such quantities that suppliers began complaining of inability to secure necessary materials.

(3) The open-end CMP plan was devised. In the relatively small area under the Controlled Materials Plan, sufficient materials were to be allocated to cover orders bearing priorities ratings.

(4) The insatiable demands of military and defense-supporting claimants began laying prior claim to the bulk of all controlled materials — steel, copper and aluminum.

(5) Producers in the so-called open areas began clamoring for some methods of being sure of at least a share of available supplies. The present all-out CMP plan became effective October 1, allocating all scarce materials—with only small-user exceptions—to authorized production schedules.

(6) Already, in recent weeks, cracks have developed in the single-band system. First was action to provide preference for programs designated as A, B, C, or E, covering Atomic Energy or Defense Department Requirements. The second was a new DX rating, intended to be a substitute for numerous NPA directives which have been used to break bottlenecks in obtaining critical materials.

In announcing the DX rating, NPA went to considerable trouble to explain that the new rating was for use in emergencies only, and would not be extended generally to create a new rating pattern. It does not seem unlikely that the new DX rating will soon become the counterpart of the World War II AAA rating which was about the only one which claimed delivery on schedule.

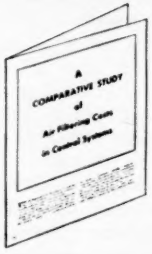
Although NPA keeps insisting that it has no intention of setting up such a selective rating plan, its actions indicate otherwise. CMP-4B forms, for example, have been changed to require a separate statement from applicants showing the value of shipments and unfilled orders in each of eight rating categories. The two top categories are DO ratings with their designating letters.

As previously stated, DO- A, B, and C ratings are for the Defense Department; E for Atomic Energy Commission. Those groups will admittedly have a preference in obtaining deliveries in the event a supplier cannot fill all of his orders.

Following are other alphabetical claimants: D, Department of the Army; F, Civil Defense, Federal Security Agency, General Services Administration, Veterans Administration and Housing and Home Finance Agency; G is also used by HHFA, Agriculture Department, Defense Transport Administration, Canada, and the Maritime Commission; H is used for department of the Interior Agencies, including Petroleum Administration for Defense, Defense Electric Power Administration, Defense Minerals Administration, and Defense Solid Fuels Administration; J, Department of Commerce and its agencies, including Maritime Administration, Bureau of Public Roads, Civil Aeronautics Administration, and Civil Aeronautics Board, as well as for departmental programs of the Department of Interior, the Defense Fisheries Administration and the Voice of America. T covers the Water Resources Division and U, construction in specified classifications. V involves consumer hard goods primarily, and MRO, self-rating for maintenance, repair and operating supplies under CMP Regulation 5.

Past experience indicates that as long as a control pattern exists, someone will insist upon trying it out to see if it will work. And as long as controls machinery is in readiness, the American public is no longer

is as bad as dirty filters!



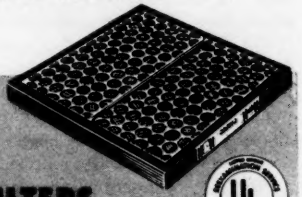
Get this Booklet—The "Comparative Study of Air Filtering Costs" contains facts, figures and charts important to anyone interested in air conditioning. A copy free on request. Write today.

What! Board up the air conditioning? That's ridiculous. But you get just about the same effect when you let dirt-choked air filters remain in your unit. You block off air flow, cut your comfort and raise your operating costs.

Regular, periodic replacement of filters is *essential* if you want to get good air conditioning and avoid costly repairs. How often should you replace them? As often as they get dirty . . . and that depends on local conditions . . . in some cases as often as once a month.

Be sure your filter replacement is handled on a definite schedule, using nationally known and accepted Fiberglas DUST-STOP* Air Filters, the replacement filters that provide high dirt-catching capacity at low cost.

Your DUST-STOP supplier can help you set up a way of handling filters systematically. Discuss it with him today. Owens-Corning Fiberglas Corporation, Dept. 41-J, Toledo 1, Ohio.



OWENS-CORNING FIBERGLAS DUST STOP* AIR FILTERS

*T. M. REG. U. S. PAT. OFF.

*DUST-STOP is the trade-mark of Owens-Corning Fiberglas Corporation for impingement type air filters made of glass fibers. FIBERGLAS is the trade-mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with fibers of glass.

the boss of what it wants industry to make. The decision as to what is essential, and sufficiently "less essential" to be discontinued, will be made by Washington bureaus instead of in the marts of trade.

Such a situation is not to the liking of either the American public or American business, but those fashioning the controls are thinking in terms of no short-time operation. Observes DPA Boss Fleischmann:

"We are now, and perhaps may be for many years, in a situation only a shade less perilous than all-out war. Since the Soviet threat may be with us for a considerable period, and since one of its goals is to break down our economy, we must go about achieving rearmament in a way that will assure us the arms and the productive capacity we need, and at the same time strenghten, rather than weaken, our over-all economy. This means building our defenses and at the same time protecting the integrity of our civilian economy.

"There lies ahead an in-between period which is going to test the mettle of our people. Until we have enough materials and plants to produce everything we need or might want for defense and for civilian use, we must channel what we have to what we need most."

Another Investigation?

In a Congress already famous for spending more time investigating than in legislating, it is not surprising to find plans afoot to investigate the entire defense program, from stem to stern. Setting up a special committee to conduct such an investigation is authorized in House Resolution 422, referred to the House Rules Committee. The investigators would be authorized to "look into all matters related to the Defense Production Administration and other agencies of the Government associated with the DPA (1) with respect to the type and quantity of critical materials available now, (a) the number and type of materials and quantity needed under wartime conditions; (2) the method and criteria by which critical materials are now being allocated (a) to industry, (b) to the public generally, (c) to the United States Government agencies, (d) to states, counties, cities and subdivisions thereof; (3) the length of time taken to act on applications for certificates of necessity; (4) the function of other agencies of the government in assisting the Defense Production Administration in submitting recommendations, and the time required and the qualifications of employees involved. The committee would also investigate the production of war goods, the construction of emergency facilities under the defense program, and the effectiveness and fairness of the price stabilization program.

Stainless Steel Turnback

Typical of some of the things the committee hopes to remedy is overestimating of needs by the military. For example, industry is enjoying a fourth quarter bonus of 20,330,000 pounds of stainless steel, returned as unneeded by military claimants. Included in the "tickets returned" is an allotment of 400,000 pounds of nickel-bearing stainless steel—the first of two such allotments expected. The returns are explained as due to a serious miscalculation of requirements of the Atomic Energy Commission. The result has been that stainless steel producers have been complaining of thin order boards, while manufacturers of consumer goods, motor vehicles and other equipment have been pleading for both chrome and nickel-bearing steel.

Meanwhile, the outlook for zinc, aluminum and copper is not so favorable. Producers of galvanized zinc sheet have been told that they must honor orders carrying A, B, D, and E designations. After that, warehouse orders, as a class, further converters as a class, and all other orders as a class will share what is left. A loss of 17,000 tons of zinc production in September is indicated and predictions are that there will be a further loss in October. The continued drought in the Pacific Northwest has procurement agencies worried over the possibility of a serious aluminum shortage. Lack of power in the Washington-Oregon area has not been considered unlikely, but now the power shortage is sufficiently serious to warrant considering moving some of the aluminum facilities eastward.

Because of the copper strike, this metal is also in short supply. Automobile manufacturers have been requested to reduce their use of the metal to an average of 32 pounds per car, from 50 pounds. Bulk of the copper used in automobiles goes into radiators. Substitutes are to be tried.

Construction Order Clarified

The NPA Construction Division closed its September book by issuing 60 new interpretations of the construction orders, CMP Reg. 6 and M-4A. Copies of the interpretation—available upon request to the bureau at Washington 25, D. C. or regional NPA offices—should prove of interest to everyone affiliated with the building industry.

The interpretations are broken down into eight divisions: controlled materials, self-authorization, copper and aluminum restrictions as contained in Section 7 of Order M-4A, individual projects, commencement or continuance of construction, multi-use projects, categories of construction, and delivery.

Solid Fuels Producers Listed

More than 3,000 producers of solid fuels have been notified that their coal and coke facilities have been assigned serial numbers to facilitate priorities and allocations assistance. Defense Solids Fuels Administrator Charles W. Connor has announced that a serialized copy of Form DSFA-1 has been sent to each producer who filed the form in accordance with SFO-1. Mr. Connor urged solid fuels producers to list the serial number assigned to their operation in any correspondence with DSFA regarding priorities assistance or other matters. He explains: "While further information may be required in support of a particular request, the availability of the information on the DSFA-1 report will eliminate the necessity for providing this basic data with each individual request."

Rumored departures of both Eric A. Johnston, Economic Stabilization Administrator, and Price Stabilizer Michael DiSalle have been confirmed. Mr. Johnston's departure is timed for late October, with Mr. DiSalle scheduled to leave sometime during the winter.

BRIEFLY STATED

• The National Production Authority, U. S. Department of Commerce, announced its Construction Controls Division had approved 458 applications for authorizations to commence construction in the fourth quarter of 1951. It denied 2,080 of the 3,784 applications received. Other action on these applications by this division, which handles authorizations to build and approves allotments of controlled materials for general commercial construction, were: transferred to other agencies, 52; notification that applicant is exempt, 848; first quarter 1952 applications (not processed), 180; pending, 140. Since the demand for structural steel for this period was 233% of the available supply and the major portion of the supply had to be channeled into direct defense programs, the remainder was apportioned among the various claimant agencies. As a result general commercial construction received only 11% of its stated requirements of structural steel for the fourth quarter.

• A pumping station with a capacity of 12,000,000 gallons of water daily, large enough to supply an entire city of 60,000 population, has been installed in the Buick foundry to circulate water through the air-conditioning system. The seven pumps, which make up the station, have a capacity of 1,200 gallons a minute each. They draw the water from two 100,000-gallon settling tanks, where it is purified, and force it through the air conditioning system.

• William A. Matheson, Jr., has been appointed sales promotion manager of International Heater Co. After graduation from Lehigh, Mr. Matheson became associated with Williams Oil-O-Matic. Later, he entered the U. S. Civil Service and then spent three years in military service. Returning to Eureka Williams after the war, he later joined the Perfex Corp.

• The election of W. A. Matheson, nationally known sales executive and consultant, as vice-president of the American Bildrok Co., manufacturers of lightweight aggregate building materials, has been announced. Mr. Matheson was formerly president of the Williams Oil-O-Matic Heating Corp., and later became executive vice-president when that company merged with the Eureka Vacuum Cleaner Company. He is now a member of the Eureka Williams Corp. board of directors.

• Fred R. Haviland, Jr., senior associate with the New York market research and management consulting firm of Stewart, Dougall & Associates, Inc., has joined Minneapolis-Honeywell Regulator Co. He will be concerned with the interpretation and development of Honeywell's marketing activities. A native of Illinois, Mr. Haviland served as research director of the advertising firm of Foote, Cone & Belding in Chicago before joining Stewart, Dougall & Associates, Inc., shortly after World War II.

• The American Society of Heating and Ventilating Engineers moved its headquarters from 51 Madison Avenue, New York City, to 62 Worth Street on October 1.

• Gaylord Wallis Penney, holder of the George Westinghouse Professorship of Engineering at Carnegie Institute of Technology, has been voted a John Price Wetherill Medal by The Franklin Institute for work in the development of a practical and commercially used electronic precipitator to remove particles of matter from ventilating air. Professor Penney was active in development of the Precipitron during his association with Westinghouse Electric Co. from 1923 to 1947.

• Appointment of J. L. Mohun as division manager, industrial insulation sales, for the Baldwin-Hill Co., has been announced. Mr. Mohun will be located at the new sales office established by Baldwin-Hill at 4101 San Jacinto Street, Houston 4, Texas.

• Earl J. Gossett, founder and president of Bell & Gossett Co., leading manufacturer of hot water heating system equipment, has been elected to the board of directors of the Oil-Heat Institute of America.

• Recent uncovering of the 40-foot bare aluminum bypass installed approximately seventeen months ago in the Alabama-Tennessee Natural Gas Company's 8-inch aluminum pipeline revealed absolutely no discoloration or corrosion of any sort. This section of pipe was installed with special bypass valves so that it could be dug up at intervals without disturbing the operation of the main pipeline serving Reynolds Metals Co.'s Listerhill, Alabama, plant.

• A grant for further studies relating to the effects of air conditioning on the human body has been established by the Mitchell Air Conditioning Research Foundation, it was announced by B. A. Mitchell, president of the foundation and of the Mitchell Manufacturing Co., Chicago. The grant has been given to Michael Reese Hospital in Chicago, and has provided two specially controlled air conditioned rooms. First experiments are under the direction of Dr. Louis N. Katz, director of the cardiovascular department at Michael Reese. Studies are to determine whether or not a controlled air conditioned atmosphere facilitates recovery from heart ailments.

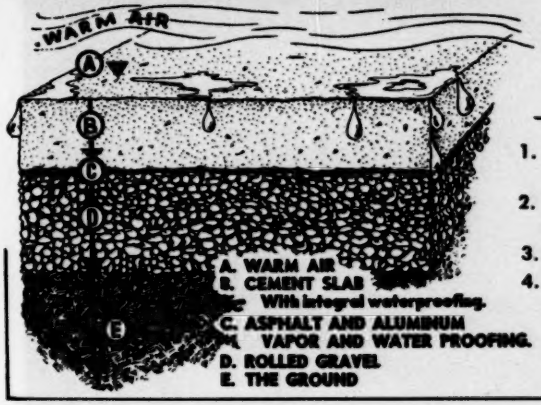
• Robert W. Engbring of Milwaukee, Wisconsin, has recently been appointed advertising manager of the Perfex Corp., Milwaukee, Wis.

• Henry B. Safford, Jr., has been appointed to the position of advertising and sales promotion manager of the General Controls Co., of Glendale. Mr. Safford, who was graduated from Dartmouth College in 1938, came to the company from New York City where he was a partner in a creative advertising services concern. For two years, 1947 to 1949, he served as advertising manager and European sales manager of the "British Magazine" in London and Paris. Prior to that he had been assistant manager of the New York office of the Lehigh Portland Cement Co. and assistant advertising manager of Jenkins Bros., a New York and Bridgeport, Conn., firm specializing in the manufacture of valves and mechanical rubber goods. He served four years in the United States Air Force as a pilot.

No waterproofing will prevent wet concrete floors

"Dampness on concrete floors is more often due to moisture from the air than from the ground. No amount of waterproofing beneath the slab will prevent this trouble."

From a "Progressive Architecture" Research Report, "Insulation for Concrete Floor Slabs on Grade."



1. The air (A) in immediate contact loses heat by conduction to the concrete (B).
2. The concrete (B) conducts heat through the layer of asphalt AND aluminum (C) to the gravel (D).
3. The gravel (D) conducts heat to the ground (E).
4. As the contacting air (A) loses heat, its capacity to retain water vapor is diminished. The excess condenses on the upper surface of the concrete floor.

THE EXPLANATION:

(1) Cold air can support little vapor. The excess falls out as water, or condensation, dew, etc.

(2) By direct conduction through and between solids, heat flows through the concrete floor into the earth, the flow in conduction being from warm to cold.

(3) Similarly, by conduction, heat flows out of the air in immediate contact with the colder concrete. That layer of air can no longer support all the vapor in it, so the excess condenses.

(4) The process of extracting heat out of the air at the upper surface of the concrete is continuous, and so is the formation of condensation.

Multiple sheets of accordion aluminum, *underneath* the floor, reflect back 97% of RADIATION. The air spaces permit only about 5% heat flow by CONDUCTION. There is of course no CONVECTION downward. Therefore with practically no heat loss, the concrete tends to follow air temperatures, and remains above the dew point. Ordinary insulations, being dense, are better conductors of heat. They are made more dense, still better conductors of heat, by the crushing weight of concrete, by inner condensation formation, and by ground dampness.

The commercial forms of multiple sheets of accordion aluminum are Infra Insulation Type 6, Type 4 and Type 4 Jr. (The built-in reflective air spaces are permanent.)

For new and inexpensive techniques in insulating floors and concrete slabs against heat flow loss, and condensation, as well as ceilings and walls, obtain FREE the revised 1951 edition of "Simplified Physics of Vapor and Thermal Insulation." Use coupon below.

INFRA THERMAL FACTORS, DOWNHEAT FLOW

Type 6	C.044 R22.72 equals 9" DRY Rockwool
Type 4	C.065 R15.38 equals 6" DRY Rockwool
Type 4 Jr.*	C.097 R10.30 equals 4 1/3" DRY Rockwool

*In 1" Space

INFRA INSULATION, INC.
10 Murray Street, New York, N. Y.
Phone: CO 7-3833

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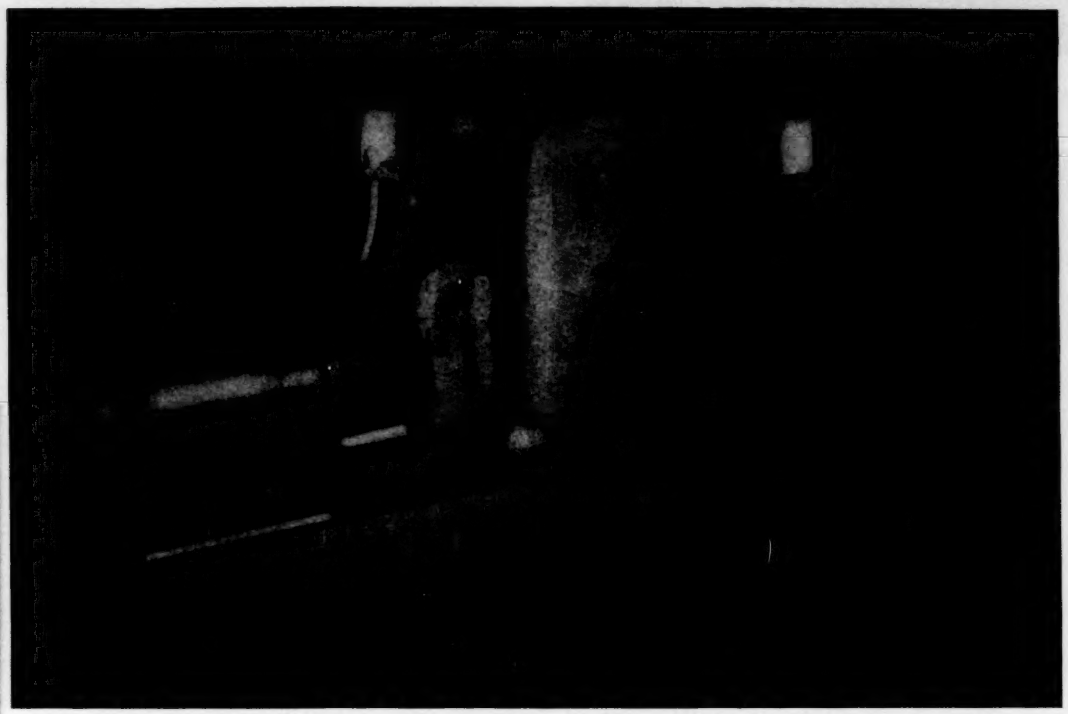
MAXIMUM EFFICIENCY FOR STEAM HEATING SYSTEMS ON HEATING, DRYING AND PROCESS WORK.



JENNINGS CONDENSATION PUMPS

Designed for steam systems on heating, drying, or process work, these pumps offer the most reliable and efficient means of returning hot condensate to boiler or hot well. In many cases these pumps will save costly installation of boilers in a pit to provide gravity flow of returns from basement radiators and heating devices.

The Jennings Condensation Pumps are sturdy and compact in construction, and combine receiving tank, pump and driving motor in a single assembly. Pumps are bronze fitted throughout, with tobin bronze shaft. The pumping impeller is of special design, made possible by our wide experience with return line heating pumps, and is especially adapted for handling hot water with the greatest possible efficiency.

Full automatic control is furnished by means of a ball float and float switch mechanism mounted on the receiving tank. All wiring is made up at the factory, and it is necessary only to connect the pump to the system and hook up the leads. Complete information regarding these economical pumps sent promptly on request.

THE NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.

Recirculation of Cleaned Air from Cast Iron Machining

ROBERT H. AVERY
American Air Filter Co., Inc.
Louisville, Ky.

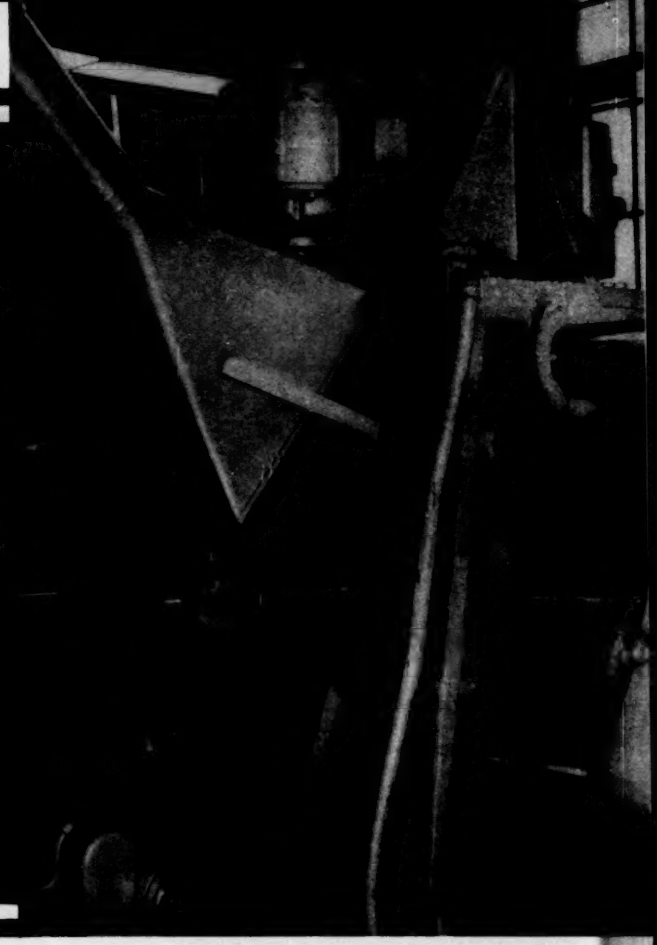


Fig. 1. Drilling machine with 6-inch exhaust branch taking 900 cfm.

Through a combination cyclone and oil-bath dust collector, air from cast iron grinding and machining operations can be returned to workrooms with savings in heating and maintenance costs.

THE requirements for a suitable dust collector to be used on cast iron machining are best explained by studying the nature of cast iron itself. When cast iron is poured and allowed to cool without annealing, soluble carbon in the molten iron precipitates, giving cast iron its greyish color. When cast iron is machined, the precipitated carbon, as graphite, acts as a discontinuous barrier so that chips come off in the form of fine granules instead of long spirals, as in the machining of steel. This characteristic of cast iron also allows much machining to be done without using a coolant.

From this explanation it can be seen that in the machining of cast iron there are two distinct products. First product is a mass of fine granular chips varying in size from one-quarter inch down to a few microns. This is better than 98% by weight of all the material generated. The other product is a graphitic carbon dust, all of it less than 40 microns in size, and most of it less than 10 microns. It is this graphitic carbon dust which is the nuisance material. Where it is allowed to escape into the atmosphere, it makes machining operations unpleasant by making operators feel and look grimy after a short time at work. The whole working area quickly becomes a dismal and depressing grey, even with good housekeeping. A sewing machine company in Ohio recently moved into a new building where the interior was painted in pastel colors. The cast iron machining department adjacent areas were painted a light blue. After less than three months of operation without local exhaust ventilation, the blue in the cast iron machining department had turned to a dirty grey, while in other departments the paint still had a new look.

The iron dust which gets into the air, while it does not constitute as unpleasant a nuisance as the carbon, does settle on machinery and thus requires additional housekeeping. In cold climates, iron dust may attach itself to moisture on windows, oxidize and produce a brown film which is difficult to remove.

Local Exhaust

By the use of local exhaust ventilation on cast iron machining operations it is possible to prevent the graphite dust from escaping into the working area.

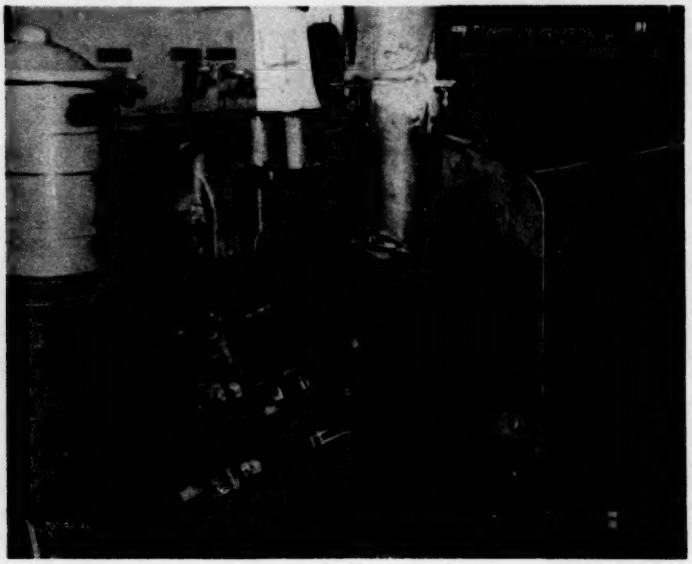


Fig. 2. A 6-spindle screw machine served by a 24-inch exhaust branch drawing 400 cfm. Note pile of chips which have fallen and collected below hood, while fines are drawn into hood and carried to separator.

It is also practical to collect the cast iron dust and lighter fraction of chips. Both dust control and complete chip disposal can be designed into one system, but experience indicates it is easier to let heavy chips be picked up manually or mechanically than to have them picked up by the exhaust system.

It is not necessary to have a high capture velocity at the point of dust generation. The dust which is to be removed by the exhaust system is not released with high initial velocity and merely tends to become air borne. As a result, low indraft through hood openings, creating general ventilation of the area where the dust is generated, will pick up this material and prevent its spread into the general working area. Typical hoods for cast iron machining are shown in Fig. 1, 2 and 3.

Note that the closer a hood is to an operation the more cast iron chips it will pick up. However, large chips do not constitute the nuisance material, and close-fitting hoods are not necessary to get effective control.

Dust Collecting Equipment

In late 1945, American Air Filter Company was first requested to investigate the problem of designing a suitable dust collector for cast iron machining by an Indiana aircraft engine company. Wet collection was not desired because of water supply and drainage problems as well as a desire to avoid handling high density

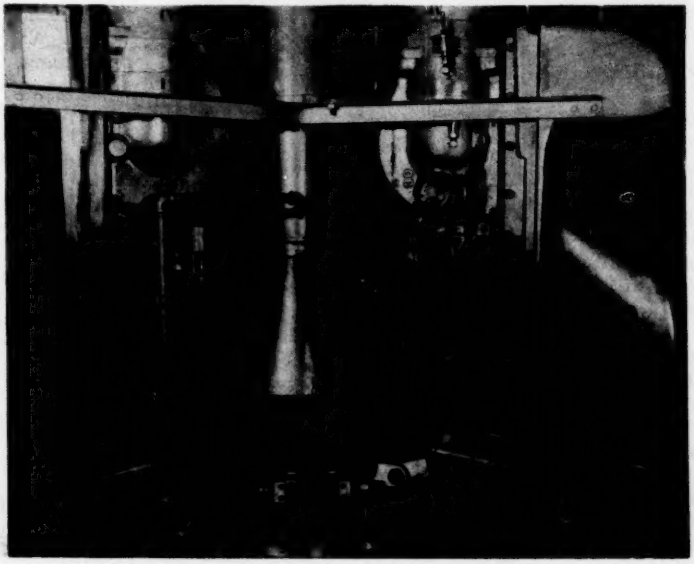


Fig. 3. A 20-inch automatic drill served by one 8-inch exhaust branch drawing 1,600 cfm.

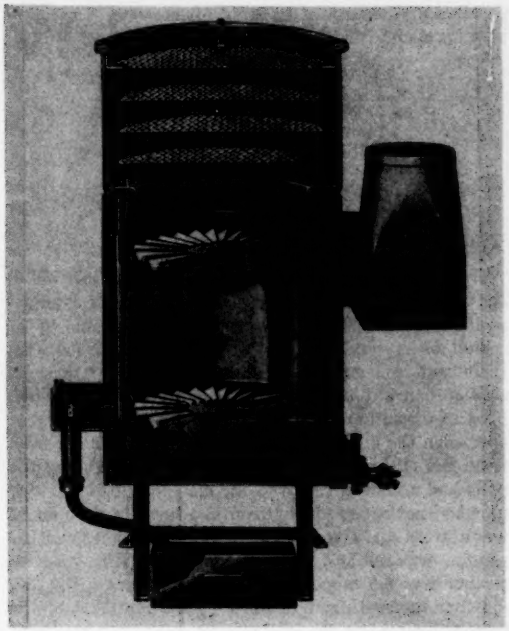


Fig. 4. (Above) Cutaway view of Cycoil oil-bath air cleaner.

sludge from a wet collector. Fabric collectors were ruled out because of space requirements.

The nature of the material to be collected indicated the need for a two-phase collecting assembly. In the first phase all of the heavy material would be removed. In the second phase, all of the fine fraction escaping Phase One would have to be collected. Because this second fraction consisted principally of very fine graphite dust it would have to be removed with a high degree of efficiency. This high collection efficiency would be necessary despite the fact that the concentration entering the Phase Two collector was very low for the conventional type of dust collector.

To perform the task of collecting the heavier fraction, it was found that either a medium efficiency centrifugal collector or a high efficiency dry dynamic precipitator with chip trap precleaner could be used.

The selection of the final cleaner presented a more difficult problem. The oil-bath type air cleaner appeared to have many advantages for this application:

(1) While it had a higher pressure drop than the viscous type of air filter, engine and compressor installations showed that it was capable of handling higher dust loads with higher efficiency.

(2) It used oil which did not evaporate and need not be replaced or renewed.

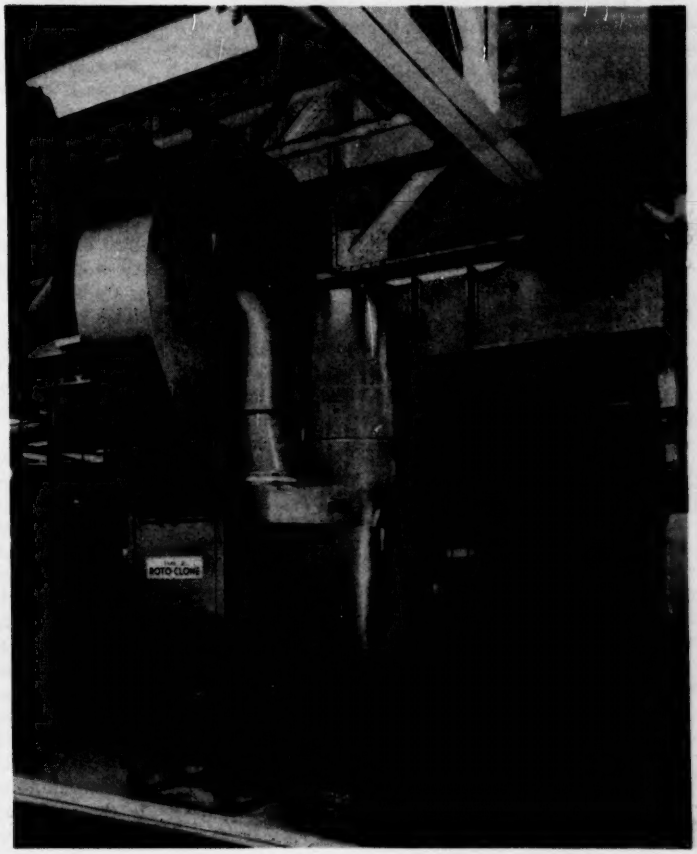


Fig. 5. (Right) Assembly of chip trap, Roto-Clone, and Cycoil aftercleaner which handles exhaust from cast iron machining operation in a southern Ohio automotive plant. Provision is made for recirculation in winter and outdoor discharge in summer

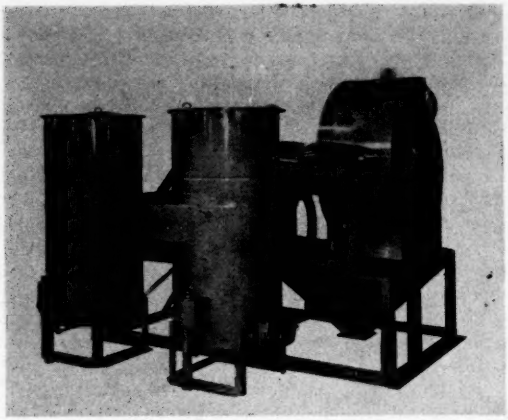


Fig. 6. Typical assembly of skimmer precleaner, exhauster (hidden from view) and tandem arrangement of Cycoil final cleaners.

(3) It occupied a minimum amount of space.
(4) It could be designed with adequate dust storage capacity.
(5) It was self-cleaning, requiring relatively little maintenance.

The present type of oil-bath air cleaner used for this application is shown in Fig. 4. Fig. 5 and 6 show the two different types of complete assemblies.

Laboratory Tests

Using a dust sample supplied by the interested company, laboratory tests were run using the two-stage equipment described. It was found that the centrifugal collector efficiency was approximately 75% and the over-all efficiency of the assembly was 99.0%.

Field Test

The laboratory tests were sufficiently encouraging to proceed with the installation of ten assemblies, each to have a capacity of 20,000 cfm. Several units selected by the owner as being typical were tested after they had been in operation for a few months. The results of these tests were as follows:

Inlet concentrations 0.715 to 0.146 grains per cu ft.
Outlet concentrations 0.00034 to 0.00098 gr per cu ft.

Impinger samples were also taken of the air being discharged from the oil-bath cleaner back to the working area. Dust counts were then made of these samples and showed an average of 1.9 million particles per cu ft.

Screen analysis of material collected by dry centrifugal showed the following *weight* distribution:

plus 150	mesh—57.7%
150-200	mesh—16.4%
220-325	mesh—16.5%
passing 325	mesh— 9.4%

The material collected in the oil-bath cleaner was de-oiled and examined under a microscope. The analysis *by count* was as follows:

Size (Microns)	*Percent by Count*
1-5	66.7
5-10	20.3
10-20	8.1
20-40	4.65
Over 40	.25

Other Tests

The success of this initial installation has since led to the use of a large number of assemblies of the type described. There are, at the present time, a total of 17 installations recirculating a total of 1,036,000 cfm from cast iron machining operations. One of these at a Michigan automotive plant was tested after it had been in operation for a full year. During the year of operation the oil had been drained and sludge removed from the oil-bath cleaner whenever necessary, but the pads had not been removed for cleaning. The air volume had not been reduced from the time the equipment was started up. Over-all efficiency of the equipment by weight was 99.5%. Dust count after the oil-bath cleaner was 3.0 mppcf.

Other interesting data included the fact that of the material escaping the oil-bath cleaner, 80% by count was in the 1-3 micron range and no particles were larger than 5 microns. Microscopic examination of some of the sludge collected by the oil-bath air cleaner showed that 83.3% *by count* of particles collected were in the 1 to 5 micron size range and 13.6% were 5 to 10 microns.

Conclusions

The installations described demonstrate that recirculation from exhaust systems handling non-toxic cast iron dust is effective and practical. The usual objections against recirculation have failed to appear.

On these installations, maintenance is reasonable. High efficiency collection has continued on units which have been in operation longer than a full year without any extended "down time" for overhaul. This experience justifies examination of objections to recirculation based on the contentions that efficiency of equipment falls off as use continues, and that continued efficiency necessary for recirculation can be secured only at the expense of frequent maintenance.

For installations of this type, if recirculation were not possible, exhaust ventilation would be unlikely due to the large volumes required to control the nuisance dust. The savings in improved housekeeping effected by the installation of a local exhaust ventilation system would be to a large extent nullified by heat losses if the cleaned air had to be discharged out of doors. It should also be remembered that on the installations described, the concentration of fine particles is higher than the conventional metal working operations such as stand grinding, portable grinding, polishing and belt sanding. This would indicate that any equipment comparable to that described should be equally efficient in cleaning the exhaust from any of these operations to make recirculation effective for this entire group.

Measures to avoid troubles in

Domestic Hot Water Systems

T. W. REYNOLDS

Difficulties in the operation of domestic hot water systems can generally be traced to faulty design. By means of simple diagrams of piping layouts, attention is directed to the cause of faulty conditions and steps that should be taken to correct such conditions.

Part 1

MORE general use of washing machines has revealed poorly planned and installed systems for heating domestic water, caused in many cases by the desire to achieve unwarranted economies, in some by failure to specify full details, and in others by penny-pinching because of competition.

The incentive to cut costs may bring about disregard of basic safety considerations. For example, there is a wide demand for a low-cost tankless coil having only 10 sq ft heating surface. This is barely sufficient for a single bathroom, and much more inadequate where the water goes too fast through the coil. Therefore, it is much better to standardize on a coil having a minimum of 12 sq ft heating surface—this will always take care of one bathroom, and where necessary may permit the addition of a second bathroom.

The Tankless Heater

There are many cases where a tankless coil is installed in an existing house heating boiler, the capacity of which was solely determined at the time of installation on the basis of heating the building. There are other cases where the low bidder convinced the owner that a smaller size of boiler would heat the building, thus saving in the first cost of the boiler. He advised the customer that such a boiler need be forced only within reason during the few days of zero weather experienced in localities such as New York. When a tankless coil is added in such an undersized boiler, the steam that develops is quickly condensed, because this type coil is submerged just below the boiler water line. There is then no steam left for distribution to the building heating system. Janitors of many buildings are familiar with this problem.

Circulators are sometimes a help in problems of this kind. For example, a large real estate management company found that the installation of a circulator pump, piped for circulation of boiler water within the boiler, increased the heat transfer rate of the boiler. Thus, where a boiler was not too greatly undersized, the operator could obtain the additional capacity required for heating the domestic hot water supply and still provide steam for heating the building.

Where there are two boilers, one with a coil, the other without, the one with a coil may not steam. Inequality of boiler water lines will then exist, unless boilers are provided with safety loops and other forms of equalization, properly designed and installed to give the same pressure in each boiler. Therefore, it is well, wherever possible, to equip both boilers with coils. While both coils can be used at one time, should one coil need repair, the other can still supply the demand.

Tankless coils should not be used in hard water areas where it is known that the tubes of installed hot water heaters generally fill up with lime and other deposits and where there is no water softening or chemical cleaning facilities in the system for periodic cleaning of tubes. As a rule, the tank type of coil is then substituted, since any precipitation of lime will be carried over into the storage tank where it can be easily removed. The tank coil tubing is then free of lime deposits for a much longer time.

The built-in-the-boiler tankless coil is not as satisfactory, under the conditions outlined, as would be an external coil because a tankless coil lies submerged in the hottest boiler water where it literally cooks while the boiler is making steam for heating purposes and no water is being drawn for the domestic hot water supply.

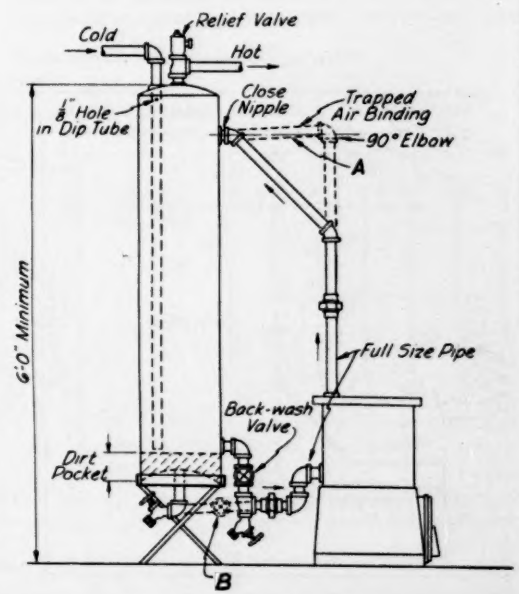


Fig. 1. A simple hot water system that can be complicated.

For best heating results, tankless heaters of the external type should be installed alongside and immediately below the water line of a steam boiler and as high as possible above a hot water boiler. The entire coil element should be capable of being removed from its shell. Sufficient space should be provided in front of the heater for inspection, cleaning, or other needs.

Simple System Often Complicated

In Fig. 1, too long a nipple or pipe is often installed at point *A* of the flow pipe from the pot stove, thus forcing the 90 deg ell up, in this way producing a pocket to cause air binding. The substitution of a close nipple and a flow pipe at a 45 deg angle, as shown in full lines, makes air binding impossible and gives less resistance to flow by shortening its path and eliminating fittings and abrupt turns.

At *B*, the bottom of the heater, a return circulation (if run as shown dotted) is quite likely to slow up or even stop circulation as sedimentation increases. All sludge settles down in the bottom of the tank and then in the return, if it is below. Eventually, it cannot be blown out. Meanwhile, as it is filling up, the pot stove must be over-fired to obtain adequate circulation and full heating. Frequent trips to the basement stove will then become necessary and it will be found difficult to maintain a banked fire which will not overheat water in the stove. Overheating the water rapidly shortens the tank life and also causes red or rusty water.

When the return circulation is connected above and free of the dirt pocket, the sediment or sludge can be blown out through a separate tank drain by opening the backwash valve. The dip in the piping at the bottom of the tank and stove can be avoided if there is sufficient headroom to allow the tank to be set up.

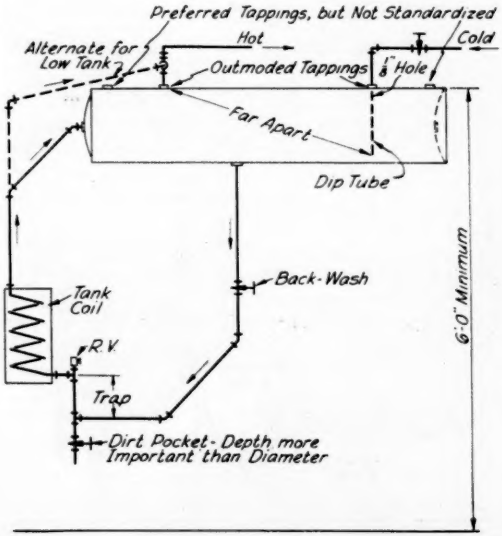


Fig. 2. Although basically a simple system, some precautions are necessary.

Generally, there is not enough room. Another point is that the pot stove, along with all heating devices, should not have their inlets and outlets bushed. If anything, these connections should be increased in size. Why pay for a relatively large heating device and then handicap it by restricted circulation due to smaller pipes which provide the effect of a smaller device? Still larger pipes should be used on the return to allow for decreased area due to sedimentation. In many return pipes, it is like blowing through a soda straw to obtain some feeble flow.

The pot stove is the oldest and simplest method of heating domestic hot water, yet invariably it is piped wrong. However, full compliance with the details in Fig. 1 will give hot water at the required temperature and quantity with the heater operating on a banked fire but two-thirds of the day. This is true even in homes having an automatic laundry unit, providing the storage capacity is at least of 30 gal. Where coal fires die out in a heater, it is usually where the grate is 10 inches or less in diameter. The minimum diameter should be 12 inches.

Care Required with Simple System

In Fig. 2, the circulating pipes are run at angles for ease of flow and for the avoidance of possible air bubble pockets that would follow had horizontal pipes been used. Since the coil offers resistance to gravity flow, a trap is deliberately formed in the piping at the bottom of the coil to prevent reverse flow. The trap is most desirable where the coil is horizontal, because it then offers more resistance, due to less vertical head and lack of continuous upward flow. The sketch covers all contingencies; no one knows whether the contractor will use a vertical or a horizontal coil.

The dirt pocket at the trap provides sufficient sediment storage if the pipe is of sufficient diameter and length. Storage provided by depth is preferable to that due to pipe diameter, for a dirt column of good height gives less dislodgement of sediment by flow or suction as water pressures change suddenly. Since few stop to think about this matter of depth, most dirt pockets are short and fat.

Obviously, the hot and cold water connections to the tank should be as far apart as possible, since pressure or pressure differential takes precedence over natural or gravity circulation when a hot water faucet is opened. However, as far apart as possible, is not as far apart as is desirable. It seems that tanks are not manufactured with tappings as close to each end as is possible. There is no reason for their present location other than standardization due to grandfather's long usage and the always present resistance to any form of change.

Tanks should have five tappings. The tank then becomes a universal tank for use in either a vertical or horizontal position. The dip tube, Fig. 2, tempers the cold water and delivers it down to where its velocity is expended and changed in direction, so that the cold water is diffused and spread along the bottom of the tank. This is better than the direct entry of cold water, shown in Fig. 3. In that layout, cold water

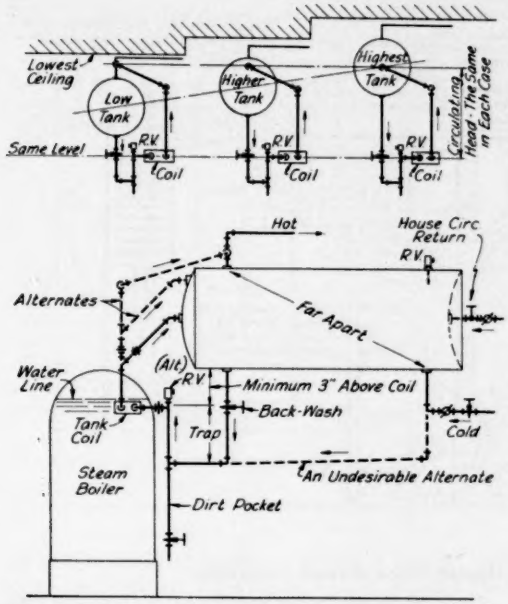


Fig. 3. Higher tank settings do not always increase the circulating head.

tends to short circuit or be pulled directly up to the hot water outlet whenever water is drawn.

Hot water in a horizontal tank builds up as shown in sloping lines, Fig. 2, until finally the water within the tank equalizes in temperature and then stratifies if no water is drawn for some time. A temperature of 155F is the critical temperature for corrosion, precipitation or sedimentation, and liming of a hot water heating coil. Such critical temperature is more likely in distribution piping where the water is not tempered by storage in the tank, but flows from the coil directly to the distribution system as shown with dotted lines in Fig. 2. More often there is no choice in the matter, particularly where the tank must be set low because of the usual lack of headroom. While this may be a fine point for the conditions cited, the lesson remains that the critical temperature should not be exceeded in coils—preferably not in any other part of the system, unless very hot water is required for dish washing or manufacturing processes.

Higher Tank Setting Not Always Good

Some of the good points shown in prior and subsequent sketches are repeated in Fig. 3. It also brings out some new points. Here again, the trap in the piping at the boiler forms resistance to reverse flow, but more particularly in this case, because of the greater resistance of a horizontal tank coil.

The tank should be installed with the bottom at least 3 inches above the coil to provide the minimum of circulating head. To set any part of a tank lower is just a waste in initial tank cost and in operation. Hot water may build down to the lower portion of the tank in time, providing the boiler is forced and some of the water overheated to above the undesirable critical temperature. In Fig. 3, note the alternate position for the relief valve at the coil.

Reference to the end elevations at top of Fig. 3 makes clear the interesting fact that within the three limits of headroom shown, nothing is gained in circulating head by setting the tank higher. Of course, the flow connections to the tank must be made correspondingly as shown. It is quite common to think otherwise, because as a rule we do not reason things out fully unless they are reduced to writing. Another question is: Where should the return circulation to the coil be connected at the tank? Quite often it is connected as shown by dotted lines. This makes a long

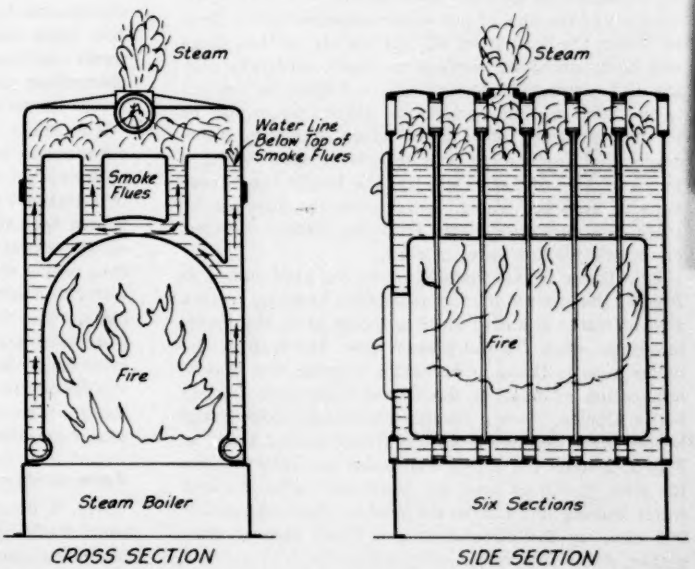
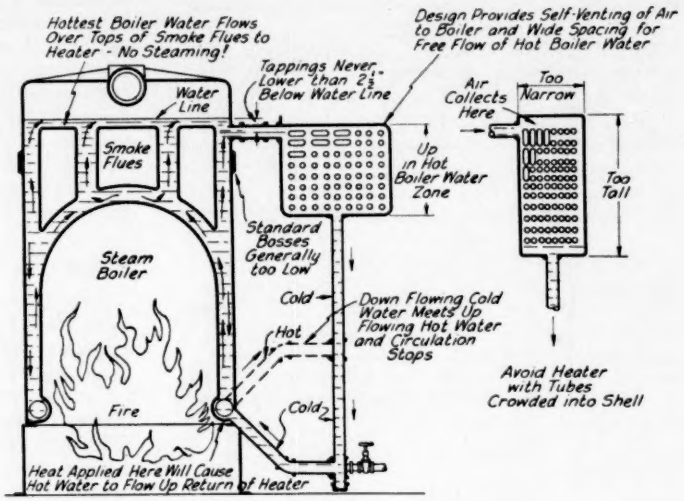


Fig. 4. Sections of a dry nipple boiler. This type boiler requires that each of the boiler sections be tapped.

Fig. 5. As a contrast to the boiler shown in Fig. 4, this is a wet nipple boiler. Illustration shows influence of heater shape on circulation.


Hottest Boiler Water Flows Over Tops of Smoke Flues to Heater - No Steaming!
Design Provides Self-Venting of Air to Boiler and Wide Spacing for Free Flow of Hot Boiler Water
Tappings Never Lower than 2½" Below Water Line
Water Line
Air Collects Here
Too Narrow
Smoke Flues
Up in Hot Boiler Water Zone
Too Tall
Standard Bosses Generally too Low
Steam Boiler
Cold
Down Flowing Cold Water Meets Up Flowing Hot Water and Circulation Stops
Hot
Avoid Heater with Tubes Crowded into Shell
Fire
Cold
Heat Applied Here Will Cause Hot Water to Flow Up Return of Heater

return with unnecessary resistance to gravity circulation as the cold water can make its way along the bottom inside of the tank to the coil with less resistance than through the pipe.

Boilers that Need Each Section Tapped

Let us next consider Fig. 4. If the boiler were what is termed a wet nipple boiler, that is, a boiler with water above the smoke flues, as in Fig. 5, then water, as it circulates first up the front section, can continue its flow quite easily across the various boiler sections in the wet area above the smoke flues. In Fig. 4, however, the boiler is known as a dry nipple boiler; in effect each section is more or less a separate boiler.

So it is most important that the external water heater be connected to each of these boilers or sections, regardless of the size of hot water heater coil; not alone to obtain the heat from all, but mainly so that there will be no untapped sections to steam, especially during the summer. Sometimes it is difficult to connect to the front section, because the water column may be on the connecting side and therefore offer some interference. A further factor is the saving of oil. With a burner nozzle of fixed capacity, the longer the burner runs to heat hot water, the greater the duration of stack and radiation losses from the boiler. Besides, one wants his hot water at once.

In a boiler heater installation of the kind shown in Fig. 5, the matter of any resistance causing reverse flow of water is not so much a factor as in the previous cases cited. In the present case, the trap at the boiler base is there to prevent a reverse flow due to application of heat at the lowest point—the bottom boiler nipples. Such a reverse flow would occur if the heater were connected as shown by dotted lines in Fig. 5. Should the dotted connection not fully reverse the flow, it will at least act in opposition to the cold water coming down from the heater. Such opposition will slow up the circulation and likely stop it altogether.

Heater Shape Affects Circulation

Standard bosses for hot water tappings provided with boilers are sometimes set too low, in which event new tappings should be made as shown with their center line not lower than 2½ inches below boiler water line. The water line should, of course, cover the top of all internal boiler flue passages. The higher tappings give greater circulating head and elevate the heater up to the hot boiler water zone. A heater of shallow depth also increases the circulation head. Obviously, to be shallow, the heater must be made wider or longer to include the necessary heating surface.

Tubing that is too crowded in the heater shell makes the over-all heater size smaller, but it does so at the expense of flow by baffling the downward passage of hot water through the heater. For example, the heater shown attached to the boiler, Fig. 5, enables water to flow easily because the loops are horizontal and the water can therefore pass through the loops instead of attempting passage entirely between them, as illustrated by vertical loops at the other heater.

A heater, shown at boiler, Fig. 5, with inner top flush with upper inside of pipe to boiler, eliminates any upper pocket in which air would collect. Any air that is released by the hot water is then automatically vented back to the boiler. If, however, the heater has an upper pocket, as shown at the right hand of Fig. 5, then pocket will collect air bubbles from the circulated water and will free others due to hotter water and boiling at this point. The boiling and collection of steam and air bubbles then build down to hinder circulation from the boiler. This makes necessary an automatic air valve on an extension pipe up from the heater. The desired condition is an absence of both pocket and air valve.

Reverse Flow for Crowded Conditions

Fig. 6 illustrates a most simple job with a small amount of piping, and shows what can be done where the space alongside the boiler is so crowded that no

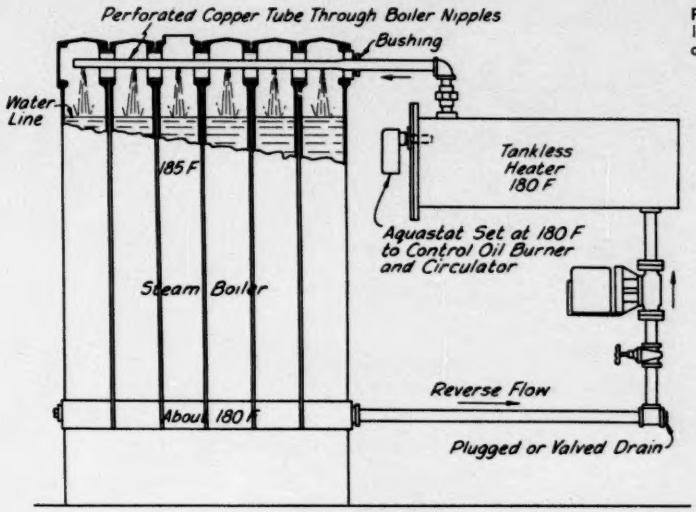


Fig. 6. Reverse flow for crowded conditions. Installation is simple and requires but a small amount of piping. Reverse flow results in greater efficiency.

use can be made of tappings on either side of the boiler. A perforated copper tube inserted through the boiler nipples distributes the water to be heated above the boiler water line. Flow through the boiler must then be reversed from normal with 180F water maintained by aquastat in the heater shell, 185F at boiler water line, and about 180F at the boiler base. This reverse or counterflow, incidentally, gives a greater mean temperature difference between gases and water and therefore gives increased boiler efficiency. Because of the positive action of the circulator, the heater can be set at an elevation lower than shown. It can even be set on the floor.

Heater Flexibly Corrected

More connections from boiler to heater can be obtained without difficulty in the installation shown in Fig. 7, because the connections, excepting two, are made with flexible unions. This method does away with the swing joints otherwise required, makes the installation close up to boiler, is desirable where space is limited, puts the heater up where the hottest boiler water is present, and increases the circulation head to a certain extent. A further advantage is that tappings can be made at all angles, a thing not possible with the usual piping arrangement. Savings are made in fittings, pipe and labor and the flow of water eased by short direct connections without turns.

The connections at each end of the heater, or any two connections, front, back or midway of boiler must be made rigid for support of the heater; but this slight departure from flexibility is of no moment, since only two connections are easy to line up. With such arrangement, one is more likely to tap each boiler section. This insures greater heating of hot water and the elimination of steaming in summer as within untapped boiler sections, and also avoids the leakage of a header having greater rigidity and more fittings.

Note also in Fig. 7 that the return circulation from the heater is made with a short rise to the boiler return header, thus forming the typical trap to prevent reverse circulation. For example, if there were no trap, a stoker would make a hot water leg at this point tending to reverse the flow. Impingement of an oil burner flame would do the same. The two return pipes do not increase friction against circulation as they are in parallel and have equal length and friction. Of course, a single return pipe of larger size giving the same friction could be used, but better support for the heater is provided by using two pipes with extensions to the floor. The two returns should be full size of heater tappings. Valves and drains are provided for periodic backwashing of the heater shell, thus keeping the unit at maximum efficiency.

(To be concluded)

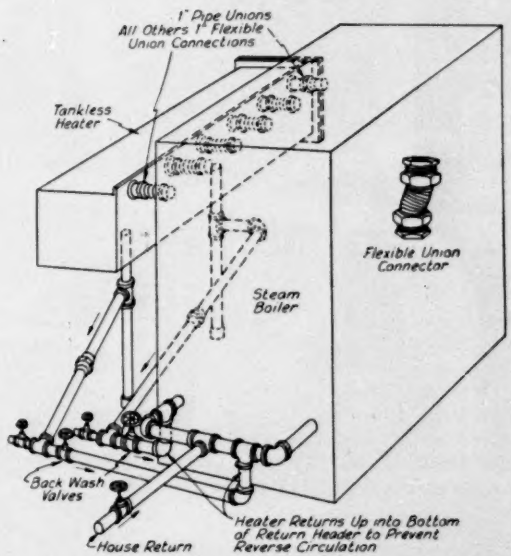
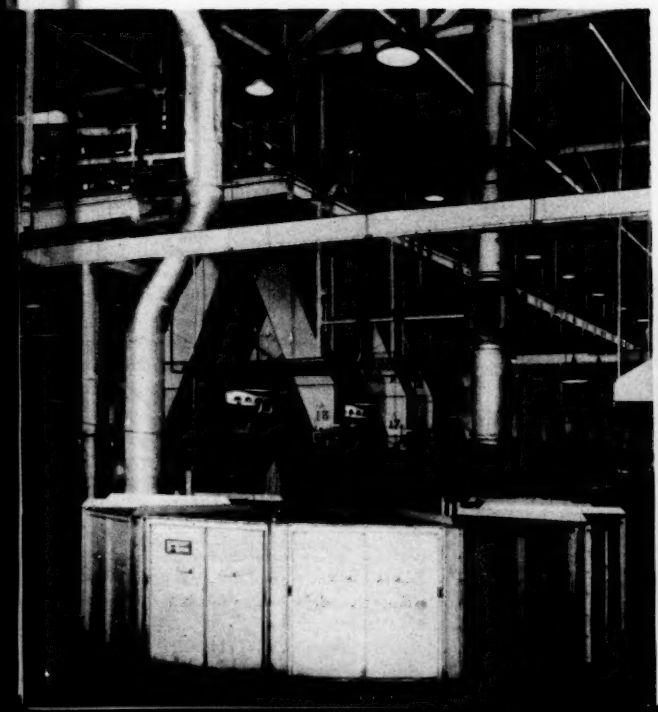


Fig. 7. Flexible unions used for heater flexibility.

New Idea Division, Avco Mfg. Co., Coldwater, Ohio, farm equipment plant with new foundry under construction by The Austin Co.

Automatic Dust-Free Foundry



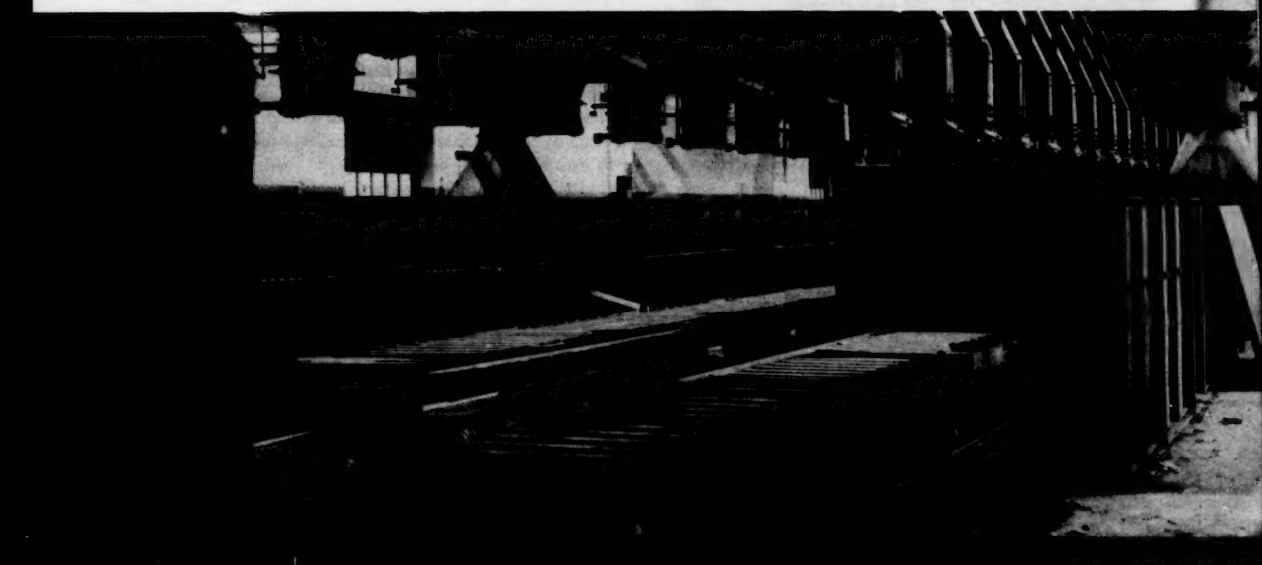
(Left) General view of molding lines with 36 molding stations visible in background. Welded H-section trusses and Jack trusses support overhead conveyors for handling sand and materials in process.

(Below) Seven tumbling barrels clean smaller castings. Note exhaust connection in background.

(Above) Daylight is abundant in production bays of the press shop. Sixty-foot trusses simplify crane operation. Steam heated space heaters warm make-up to replace 250,000 cfm exhausted air from foundry operations.

(Right) Cooled molds are picked off line by hoist and placed on shakeout with sand recovery pit and side exhaust.

(Below) Individual sand hoppers for 36 molding stations on small parts production line photographed during construction of the foundry.



Constructing the Steam Service to Henry Ford Hospital

W. D. McCULLY
Engineer, Underground Lines Department, The Detroit Edison Co.
Detroit, Michigan

Details of how a 16-inch steam main was installed to serve a large Detroit hospital. This was presented as a paper before the Detroit Convention of the National District Heating Association.

EXTENSION of the steam distribution system to serve the Henry Ford Hospital was started by The Detroit Edison Co. in January, 1951. Since this hospital is located to the northwest of the existing steam distribution system, it required construction of 11,500 ft of 16-inch main. This service represents an immediate steam requirement of 35,000 lb per hr to be soon increased to 70,000 lb, with prospects of eventually reaching 100,000 lb per hr.

The nature of the steam requirements and its location made it desirable to provide two separate steam lines to this hospital. The route of these two lines is shown in Fig. 1.

The choice of route and, in several sections, the type of construction and construction methods were influenced by the fact that a depressed expressway is being built along the general route of Hamilton Avenue, separating the hospital from the existing distribution system. While it would have been desirable to cross Hamilton Avenue in either the Milwaukee Avenue or Grand Boulevard bridge, work on these structures was too far advanced at the time the customer signed the contract to permit this solution. Absence of deep sewers in Hamilton Avenue made it undesirable to cross under the depressed expressway, and a pipe bridge would not have fitted into the landscape. The final solution was to cross with one line at Bethune, where the roadway is not yet depressed, with the provision that it will later be relocated in a bridge to be built at Pallister Avenue one block north; the other line to cross the expressway within the structure of the existing railroad bridge south of Baltimore Avenue. The line was constructed to the cross-section that has been standard with this company for many years. Pertinent features are a 4-inch underdrain, stainless steel supports, and a 2-inch air space between the insulation and the concrete envelope. Pipe is of ⅜-inch wall with 2 inches of insulation. Valves are flanged 150 lb steel and slip joints 150 lb steel with welding ends mostly 12-inch traverse. Length of line expanding into a joint is limited to 400 ft. The concrete of the envelope contains 4 sacks of cement and 100 lb of fly ash per cubic yard.

Fig. 1. Route of two 16-inch main extensions to serve the Ford Hospital.

Since construction was carried on through the cold weather of January and February, it was necessary to provide heat for curing the concrete envelope. Although the envelope was poured of heated concrete and quickly covered with protecting materials, it was felt that the quantity of heat retained was too small to offset the low temperature of the pebbles and the surrounding soil. Accordingly, a 25 hp portable boiler was procured and set up at a convenient point along the trench. As soon as a section of bottom slab was poured, steam from the boiler was blown into the end of the underdrain at a manhole excavation. This steam, flowing along the underdrain and escaping from the open joints of the bell and spigot crock, effectively heated the surrounding materials. The covering of tar paper and marsh hay then served to retain the heat until the concrete had set. The boiler was also used to apply heat to the 16-inch pipe while the upper part of the concrete conduit was setting up. This procedure was considered necessary only when pouring concrete at a temperature below 20F or when the banks of the trench had been frozen to a considerable depth.

At several points the lines crossed under pavement newly constructed as part of the expressway project. The permit authorities were naturally reluctant to

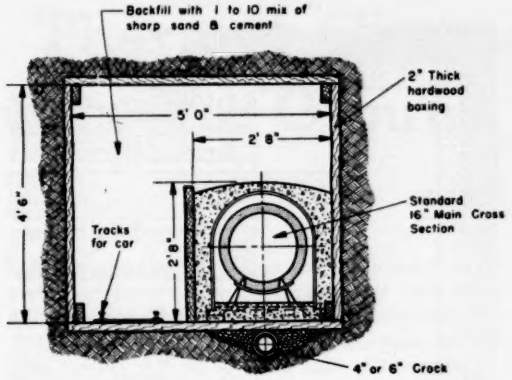


Fig. 2. Construction in the long tunnel under the expressway.

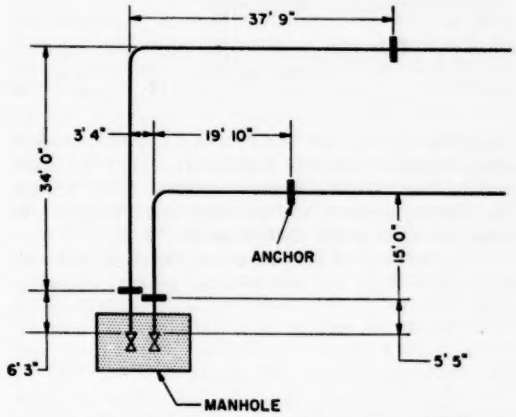


Fig. 3. Location of anchors near the service manhole.

have this pavement cut or to have any interference with the traffic which had just been routed onto the new pavement. Accordingly, they requested that installation be made by tunneling under certain areas. This represented little change from the usual procedure of excavating small tunnels for street crossings except in the matter of length, some running as long as 200 ft. The height of these tunnels was limited by existing utilities. A method of construction had to be worked out with the contractor which would provide sufficient room to install the pipe, pour the concrete envelope, and do a proper job of backfilling. A cross-section of a typical tunnel of this type is shown in Fig. 2.

Only bare clearance was provided for the mud cars 26 inches wide. Welding was done at the tunnel entrance, the pipe being moved forward into the tunnel as each weld was completed. When the pipe was in place, tested and insulated, a form of 2-inch lumber was erected along the edge of the bottom slab and concrete shoveled from the mud cars over the top of the form. After stripping the forms and waterproofing, the remaining tunnel space was backfilled with a one to ten mixture of cement and sharp sand. This operation was begun at the midpoint of the tunnel and proceeded in both directions simultaneously, the sectional track being removed as the backfilling progressed.

In Hamilton Avenue at the north line of the abutment, the pipe rises vertically to an elevation 2 ft below the bridge girders, then runs horizontally along the face of the abutment supported on steel brackets. It then turns 116 degrees, passes through the abutment in a 22-inch pipe sleeve, and thence over the expressway between the two outside girders of the expressway bridge. This was feasible because the diaphragms between these two girders carry little load, their chief function being to back up the plates supporting the ballast for the railroad bed and would not be seriously weakened by the cutting of the 20-inch circular openings for the installation of the steam main. In order to install the pipe, it was necessary to excavate to the east, along the ends of the ties, a distance equal to about 45 feet, the longest pipe length. Since the crushed stone ballast was resting upon a fill of pea gravel, it was necessary to drive steel sheet piling before excavating. The pipe was welded in position, the welders sitting astride the pipe, between the bridge girders.

Concrete Sidewalk

Since the Hamilton Avenue underpass is subject to occasional flooding during flash storms, it was thought advisable to keep the main, as it approaches the underpass from the north, above this floodline. As a result, at the north end of the Hamilton bridge abutment, the grade of the steam main rises close to, and finally emerges above, the sodded surface of the embankment, creating a problem in landscaping. Experience had shown that sod could not be maintained on less than three feet of cover over a main and the permit authorities envisioned and unsightly strip of bare earth along their landscaped embankment. A solution satisfactory to all involved was to cover the entire area in question with a 4-inch concrete sidewalk, although pedestrian

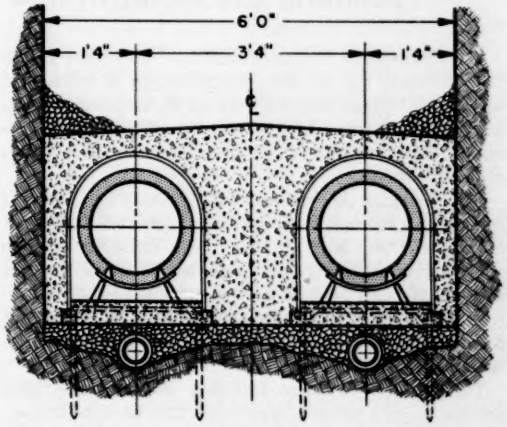


Fig. 4. Cross-section at the service manhole.

traffic is blocked off from this side of Hamilton Avenue. For the conduit protruding above the walk, the concrete was proportioned, the corners canted, and the surface rubbed to blend as well as possible with the adjoining concrete abutment.

Special Problems

West of Third Street and south of the railroad, the line passes for several hundred feet under an area which will be used in the future for coal storage. Some concern was felt that water, percolating down through the coal pile, might have a corrosive effect on the concrete conduit. Several preventive measures were considered, including paving the entire area with asphaltic concrete and the use of admixtures in the concrete of the envelope. Finally, these were discarded and the conduit was poured of a dense mix concrete containing 6 sacks of cement and 100 lb of fly ash per cubic yard. The wall thickness was increased from 4 to 6 inches.

A variation from standard construction was necessary where the two separate lines in Bethune turn south and cross the street to the service manhole. As shown in Fig. 3. Expansion of a short section of line each way from the 90 degree bends is taken up by the flexing of the pipe between the anchored points. This subjects the anchors at the face of the manhole to considerable bending moment and special reinforcement was necessary. The lines enter the manhole on 3-ft 4-inch centers which provide a 16-inch separating wall, Fig. 4. At the manhole face, this wall was extended vertically to act as a vertical beam, its ends backed up by the roof and floor slabs of the manhole. Beam reinforcement was provided to absorb the longitudinal thrust of the anchors. Reinforcement against the bending moment was provided by horizontal bars along the ends of the anchors as in Fig. 5.

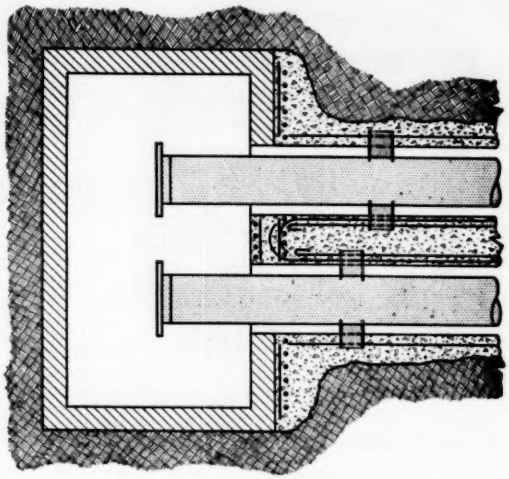


Fig. 5. Anchoring double steam mains at service entrance manhole.

Other sections of the line are of standard construction. Both lines are scheduled to go into operation soon.

Modern Air Conditioned Structures for New Orleans

Four buildings within a radius of 10 blocks in old New Orleans will be air conditioned by Worthington apparatus. These buildings, all on St. Charles Avenue, are: The Orleanian Apartments, The Mayflower Apartments, The Georgian Apartments, and the Lowich Veterans Building.

The Georgian Apartments will be cooled by a 165-ton centrifugal refrigeration system which chills 495 gpm of water from 50F to 42F. The building will be equipped with individual room conditioners so that each tenant can control the temperature to suit himself. The system was designed by James M. Todd and Associates and installed by the James F. O'Neil Co., both of New Orleans.

The Lowich Veterans Building uses a centrifugal refrigeration system to produce 273 tons of refrigeration while cooling 818 gpm of water from 52F to 44F. Air units are located on each floor. Comfortair Company, Inc. installed the Worthington system and did the mechanical, electrical and plumbing work in the building. The engineer was Herman Blum of Dallas, Texas. This building is already occupied by the New Orleans regional office of the Veterans' Administration.

The Orleanian Apartments has installed a system similar to that being used in the Lowich Veterans Building. Contractor was Sciambra and Masino, and the consulting engineer, A. R. Salzer, Jr.

The Mayflower Apartments will install two compressor units with a total tonnage of 175 tons. Engineer is Laureal and Moses, and the contractor, American Plumbing and Heating Co., both of New Orleans.

These four buildings are part of the post-war building boom which is beginning to change the skyline of New Orleans for the first time in 20 years. In 1950, the city issued permits to build structures costing ninety-three million dollars—an all-time record.

Thermal Characteristics of Soils for Ground Coil Design

WILLIAM PARKERSON

Data for ground coil design are admittedly incomplete, but for engineers who must put heat pump jobs in today, this analysis of available information and the resulting presentation of formulas for soil heat transfer will be a useful tool.

THE ground we tread, is complex stuff. It does not disclose its secrets readily. The manner in which it cools and heats, swells and shrinks, gives up heat and absorbs it, is not an open book for anyone to read. Yet, for intelligent, economical, safe, ground coil design, the engineer *must* have certain knowledge. Slowly this necessary knowledge is emerging from the tireless work of numerous soil research scientists. But, much of the research has been unrelated, individualistic, almost whimsical. Thus is it always, in the youth of every science, before a manifest purpose takes shape. Then the task of correlating divergent data must be accomplished, to fashion design tools for the engineer and blueprint design procedures that will stand the tests. The design engineer stakes his fortune, as well as his reputation, on the soundness of his basic data. He must be sure. He cannot indulge in wishful thinking. On the other hand, his margin of safety must not be such as to eliminate him from competition. He must be right.

Soil classification is a fascinating topic which has been highly developed. At least two comprehensive systems are employed. W. O. Smith, formerly of the United States Department of Agriculture and now with the Interior Department's Geological Survey, adheres to the Nikiforoff system (1)[1], while Donald M. Vestal, Jr., of the Texas A. & M. Research Foundation, recommends very highly, the Casagrande classification (2). However, soil classification will concern the design engineer only when close correlation between classification and thermal characteristics has been established. This, unfortunately, is not yet.

What then is the hopeful sign on today's soil-science horizon? Some promise appears to lie in the development of a theory of soil mechanics introduced by W. O. Smith (3) and carried forward by J. H. Neher of the Philadelphia Electric Company (4). An exposition of this theory and a derivation of the associated formulas appear under the next subhead in this article. The final result is a set of graphs and a table of very simple formulas for calculating all the thermal characteristics of a given soil in its dry, saturated, or frozen-saturated state, if only the dry apparent density of a representative undisturbed soil sample be accurately known.

[1]Figures in parentheses refer to appended references.

A little consideration of what takes place within the cylinder of soil immediately surrounding a buried pipe acting as a heat source or heat sink, will indicate the usefulness of such formulas and graphs. In all soil experiments, it has been evident that moisture moves in the direction of heat flow; that is, from a region of higher, to one of lower temperature. Whether this moisture migration is accomplished by a capillary movement or by successive vaporization and condensation or some other method or some combination of methods, is not certainly known, though several research projects have attempted to determine the exact character of this phenomenon. But whatever the mechanics of the process, the effect is that the soil immediately surrounding a cold pipe soon becomes saturated with moisture, and that surrounding a hot pipe soon loses its moisture content as the flow of heat progresses. Two conclusions follow:

1(a) Due to the influx of moisture, the soil around the cold pipe swells, compacts, improves the thermal contact and the heat flow between soil and pipe.

(b) Conversely, the efflux of moisture from the region of the hot pipe causes the soil to shrink, loosen, and even, in extreme cases, to withdraw sufficiently to leave an insulating air gap around the pipe.

2(a) Since the soil around the cold pipe rapidly becomes saturated, the soil characteristics for saturated soil may be employed in the design of a ground coil heat source.

(b) While the soil around the hot pipe rapidly loses its moisture, it cannot be considered "bone dry" out to the point where the temperature gradient flattens off and where normal moisture content obtains. Nevertheless, recognizing the probability of poor thermal contact between soil and pipe, and the shrunken and loosened condition of the soil due to drying, caution dictates the use of dry-soil characteristics until experience justifies a moderate weighting with saturated-soil characteristics.

It will be shown that the conductivity of dry soil varies widely, depending on the character of the soil. For a soil having a dry apparent density of 100 lb per cu ft, the spread of conductivity from maximum to minimum, is 65.2% of its middle value. The corresponding spread of values of conductivity for saturated soil is 10.2%. That for frozen-saturated soil, only .54%.

Thus, from every standpoint, nature not only favors the use of a buried ground coil as a heat source, but also at the same time renders design for this function

much more exact and reliable than for heat dissipation.

Heat pumps employing ground coils are better adapted to northern climates where air temperatures in midwinter are less favorable for air-to-air design, than in the South. Under these circumstances, during the heating cycle, use of the ground as a heat source may predominate in northern latitudes.

Finally, it is hoped that a practical and reliable procedure for the design of ground coils to be used as heat sources will soon be ready for publication. In this procedure, it is the present plan to employ soil characteristics as set forth in this article.

Theory

Following is a liberal interpretation of the theory advanced by W. O. Smith (3) in 1942.

Consider a cube of simplified and idealized dry soil—one foot on each edge. Maintain a one-degree temperature difference ($\triangle t$) between top face and bottom face. Assume no radiation loss or gain from or to side faces. The quantity of heat (H) in Btu which flows in one hour, from top face to bottom face, through the cube of soil, under these conditions, will represent the effective thermal conductivity (K) of the soil.

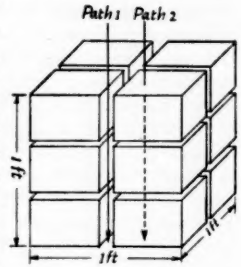


Fig. 1. Idealized soil block.

Now the heat which flows from top face to bottom face of the soil cube may choose either of two paths, as shown in Fig. 1:

(1) An uninterrupted downward air path, by-passing soil particles and the blocked-off air between them;

(2) Heat may flow successively through soil particle, air space, soil particle, air space, and so on, using only the small air gaps between particles in a vertical direction.

If we let P_p represent the aggregate volume of soil particles, P_s, the total volume of air space in the second alternate heat path, and P_v, the total volume of all air in the soil cube, then $P_v - P_s$ will be the volume of the first alternate heat path. Also $P_p + P_s$ will be the volume of the second alternate heat path.

By means of algebraic manipulation of like numerical values without regard to dimensions (for instance, setting the horizontal area occupied by particles equal to the sum of two volumes, $P_p + P_s$, in a procedure made possible by the value of unity for volume, face area, and depth of the cube), Smith derived an expression for K showing it to be the sum of two conductivities modified by the fractions of void and solid in the cube, as

$$K = k_a P_v + (1 - P_v)\, k_o = k_o - P_v (k_o - k_a) \quad \ldots\ldots (1)$$

in which

$$k_o = \left[\frac{(1+S)^2}{\frac{1}{k_p} + \frac{S}{k_a}} - S k_a \right] \quad \ldots\ldots (2)$$

In equations (1) and (2), P_v is a measure of the porosity or the per-unit volume of void space in the soil; k_a is the thermal conductivity of air; k_p is the thermal conductivity of solid soil particles; and S is a soil structure factor introduced by Smith and defined as the ratio, P_s/P_p.

It is obvious that:

$$\rho_D = \rho_p (1 - P_v)$$

where ρ_D = dry apparent density of soil,
and ρ_p = density of solid soil particles,

from which

$$P_v = \frac{\rho_p - \rho_D}{\rho_p} \quad (3)$$

When equation 3 is combined with equation 1 and simplified we get:

$$K = k_a + (k_o - k_a) \frac{\rho_D}{\rho_p} \quad (4)$$

Smith experimentally evaluated S for sixteen soil samples with the results indicated in Table 1.

TABLE 1.—SOIL STRUCTURE FACTORS.

Soil Structure	Structure Factor of 16 Samples	Mean Soil Structure Factor, S
Coarse blocky	0.039	0.0375
	0.036	
Coarse platy	0.041	0.041
Medium blocky	0.045	
	0.044	
	0.046	0.0467
	0.045	
	0.047	
	0.059	
	0.041	
Medium platy	0.051	0.052
	0.053	
Fine platy	0.054	0.054
Medium granular	0.069	
	0.060	0.0645
Finely fragmented		0.072
Fine granular	0.094	0.094
Weighted average Mean S	0.0515	0.0582

Neher argues, with reason, that, if the void spaces are completely filled with water (or ice) instead of air, the same general equations for determining K and k_o will apply, with k_w (or k_l) substituted for k_a. Neher, using Smith's values of S, indicates appropriate values for k_a, k_w and k_l; and tabulates the corresponding calculated values for k_o. Table 2 represents merely a revision of Neher's tabulation. In it, have been employed slightly different S factors, taken from Table 1, and also slightly different values of k_a, k_w, k_l, and k_p, taken from sources indicated in Table 3. Moreover, all of the quantities used throughout this article, have been converted from cgs to more familiar engineering units; all values for thermal conductivity, for instance, have been given in Btu (ft) per (hr) (sq ft) (F). Now employing equation (4), the first four lines of formulas in Table 4 may be secured.

Whereas, Neher related all soil characteristics to porosity (P_v), the present Table 4 relates all soil characteristics to the dry apparent density of the soil (ρ_D). Fig. 2, 3, and 4 are graphical representations of the formulas in Table 4.

The formula in Table 4 for specific heat of saturated soil may be deduced from Kersten's formula:

$$c = \frac{100\,c_D + M}{100 + M}$$

where c_D = specific heat of dry soil or solid soil particles = .17

and M = percent moisture content (dry basis) = $\dfrac{168.56 - \rho_D}{.027\,\rho_D}$

The formula for specific heat of frozen saturated soil follows by analogy; substituting in the derivation, the density of ice for that of water.

The formula for density of a saturated soil follows from the assumption that the wet apparent density of a saturated soil would be equal to the dry apparent density of the soil, plus the weight of the necessary water to fill the voids—both textural and structural. The density of frozen-saturated soil is secured in a similar manner.

From the foregoing presentation of theory developed by W. O. Smith and carried forward by J. H. Neher, it would seem possible to calculate all the necessary soil characteristics for the design of heat pump ground coils, when used as a heat source, if (a) it may be assumed that the soil surrounding a ground coil, acting as a heat source, rapidly becomes saturated with moisture, and (b) if the dry apparent density of an undisturbed sample of the soil can be accurately determined. The first assumption is proposed and supported in Neher's paper and appears to be concurred in by Donald M. Vestal, Jr. (5). This effect is the natural outcome of moisture migration. The second assumption is valid if proper precautions are taken, as described in the paper by W. O. Smith, and elsewhere to preserve the natural condition of the soil as it exists on location. It has been found time and time again,

TABLE 2.—CONDUCTIVITY AND STRUCTURE FACTORS OF SOILS WITH AIR, WATER, AND ICE IN VOIDS.

Soil Structure	Structure Factor, S	Conductivities for Three Conditions in Voids					
		Air		Water		Ice	
		k_a	k_o	k_w	k_o	k_i	k_o
Coarse blocky	0.0375	0.0133	0.3136	0.337	1.4848	1.10	1.6364
Coarse platy	0.041	.....	0.2931	.....	1.4723	.....	1.6355
Medium blocky	0.0467	.....	0.2654	.....	1.4527	.....	1.6342
Medium platy	0.052	.....	0.2443	.....	1.4352	.....	1.6329
Medium granular	0.0645	.....	0.2068	.....	1.3966	.....	1.6301
Finely fragmented	0.072	.....	0.1899	.....	1.3752	.....	1.6284
Fine granular	0.094	.....	0.1547	.....	1.3184	.....	1.6237
Mean	0.0582	.....	0.2383	.....	1.4193	.....	1.6316
Weighted average	0.0515	.....	0.2461	.....	1.4368	.....	1.6330
Average per cent variation from mean	27.37	.....	19.58	.....	3.34	.....	0.22

TABLE 3.—SELECTED[1] BASIC DATA FOR GROUND COIL DESIGN.

Item	Substance			
	Air at 32F	Water at 39F	Ice at 32F	Soil Particles
Specific gravity[a,b,c]		1.000	.917	2.70
Density (ρ),[a] lb per cu ft		62.43	57.25	168.56
Conductivity (k),[c,d,e] (Btu) (ft) per (hr) (sq ft) (F)	.0133	.337	1.10	1.646
Specific heat (c)[b,d,e]		1.000	.490	.17

[1]Values of data are averaged or selected from sources indicated by exponent letters as follows:
a—Smithsonian Tables.
b—M. S. Kersten "Laboratory Research for the Determination of the Thermal Properties of Soils."
c—W. O. Smith "The Thermal Conductivity of Dry Soil." (Average of 16 Samples).
d—Handbook of Chemistry and Physics—1947 edition.
e—Mark's Mechanical Engineers' Handbook—4th edition.

TABLE 4.—THERMAL CHARACTERISTICS OF SOILS.

Soil Constant		Dry Soil	Saturated Soil	Frozen Saturated Soil	Units
K	Maximum S	$.0133 + .001782\rho_D$	$.337 + .0068\rho_D$	$1.10 + .003182\rho_D$	(Btu)(ft)/(hr)(ft²)(F)
	Wtd avg S	$.0133 + .001381\rho_D$	$.337 + .006525\rho_D$	$1.10 + .003162\rho_D$	(Btu)(ft)/(hr)(ft²)(F)
	Mean S	$.0133 + .001335\rho_D$	$.337 + .006421\rho_D$	$1.10 + .003154\rho_D$	(Btu)(ft)/(hr)(ft²)(F)
	Minimum S	$.0133 + .000839\rho_D$	$.337 + .005822\rho_D$	$1.10 + .003107\rho_D$	(Btu)(ft)/(hr)(ft²)(F)
Specific heat, c		.17	$\dfrac{62.43 - .2004\rho_D}{62.43 + .6296\rho_D}$	$\dfrac{28.05 + .0036\rho_D}{57.25 + .6604\rho_D}$	Btu/(lb)(F)
Density, ρ		ρ_D	$62.43 + .6296\rho_D$	$57.25 + .6604\rho_D$	lb/ft.³

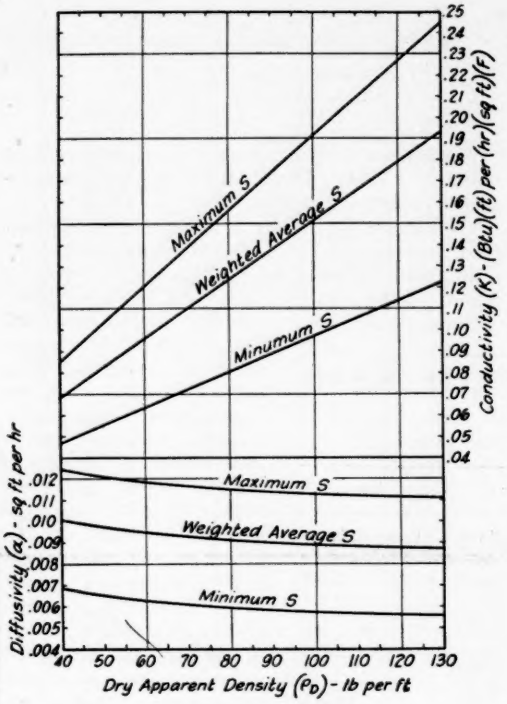

Maximum S
Weighted Average S
Minimum S
Maximum S
Weighted Average S
Minimum S
Diffusivity (a) - sq ft per hr
Conductivity (K) - (Btu)(ft) per (hr)(sq ft)(F)
Dry Apparent Density (PD) - lb per ft

Fig. 2. Thermal characteristics of dry soil.

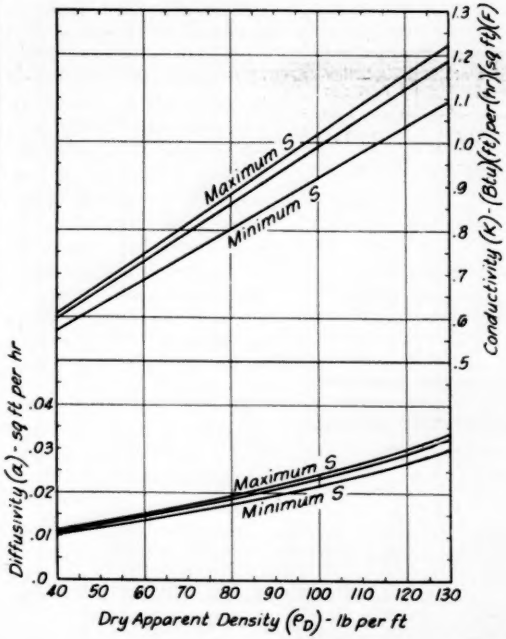

Maximum S
Minimum S
Maximum S
Minimum S
Diffusivity (a) - sq ft per hr
Conductivity (K) - (Btu)(ft) per (hr)(sq ft)(F)
Dry Apparent Density (PD) - lb per ft

Fig. 3. Thermal characteristics of saturated soil.

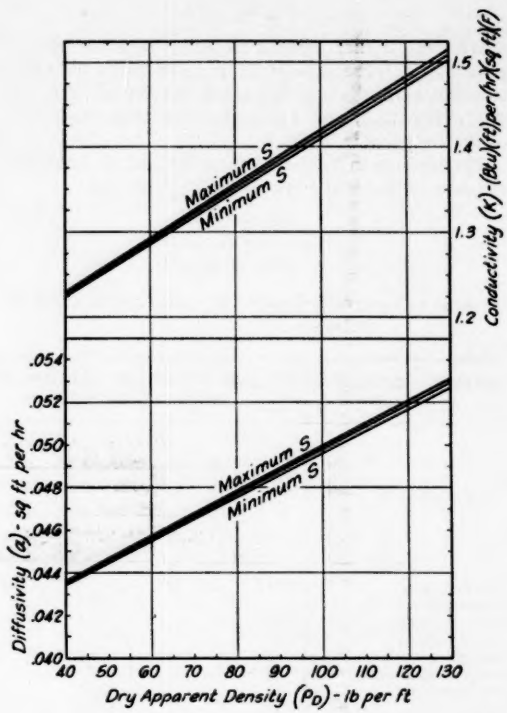

Maximum S
Minimum S
Maximum S
Minimum S
Diffusivity (a) - sq ft per hr
Conductivity (K) - (Btu)(ft) per (hr)(sq ft)(F)
Dry Apparent Density (PD) - lb per ft

Fig. 4. Thermal characteristics of frozen-saturated soil.

that a disturbed soil sample will not have the same dry apparent density as the undisturbed soil, unless compacted to exactly the same density, and even then, other soil characteristics will not be the same for the disturbed sample as for the undisturbed soil, because of change in arrangement of particles, etc. Once an accurate determination is made of the dry apparent density of an undisturbed sample of soil, all the other necessary soil characteristics should follow very simply from the formulas of Table 4.

It is neither imagined nor claimed that the postulated ideal soil cube represents or even approaches reality. Nevertheless, the theory does demonstrate and evaluate the interrelation and correlation among the several soil characteristics essential to ground coil design.

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(1) Nikiforoff, C. A., Morphological Classification of Soil Structure, *Soil Science*, Vol. 52, 1941, pp. 193-211.

(2) Casagrande, Arthur, Soils Classification, *ASCE Proceedings*, Vol. 73, No. 6, Part I, June 1947, pp. 783-810.

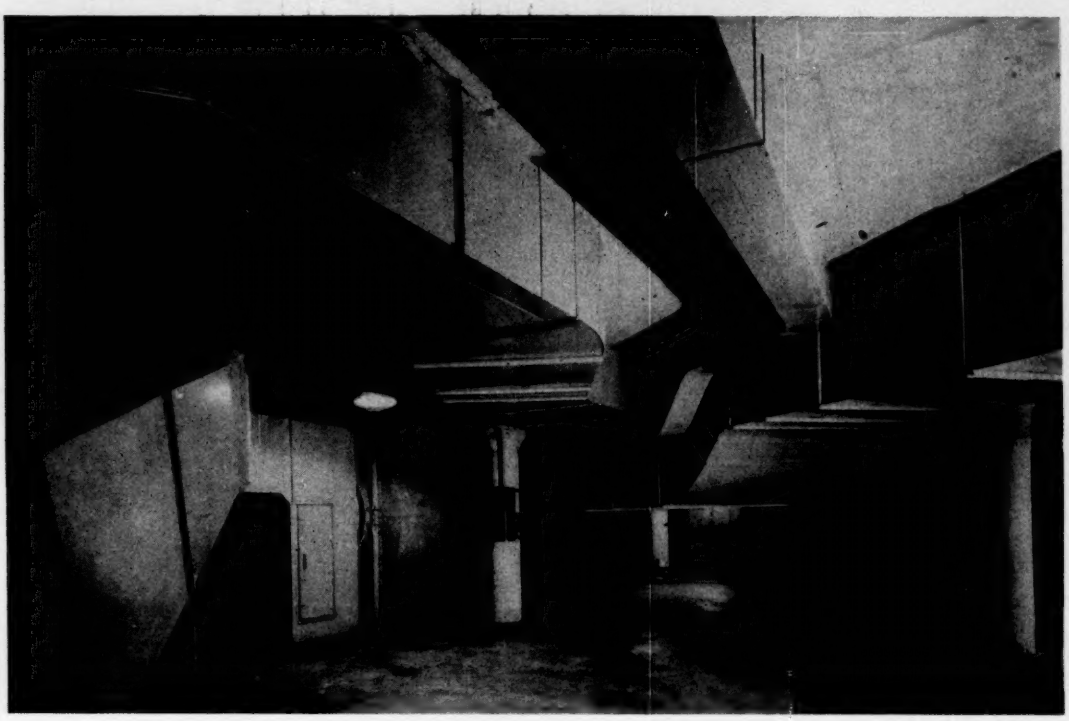
(3) Smith, W. O., The Thermal Conductivity of Dry Soil, *Soil Science*, Vol. 53, No. 6, June 1942, pp. 435-459.

(4) Neher, J. H., Theoretical Equations for Thermal Conductivity, Capacitance, and Diffusivity of Dry, Saturated, and Frozen-Saturated Soils in the Natural State, Philadelphia Electric Company (unpublished paper).

(5) Vestal, Donald M., Jr., Some Aspects of the Soil Problem in Connection with Heat Pump Buried Coil Design, *Proceedings of the Midwest Power Conference*, Vol. XI, April 1949, pp. 279-287

Pointers on Air Conditioning Duct Design and Installation

A presentation of practical information on duct specifications, design and installation procedure



Pointers on Air Conditioning Duct Design and Installation

The important link between equipment for conditioning air and the air supply outlets in rooms is the system of air distribution ducts. Practical data are presented on duct specifications, design and installation practice through the courtesy of York Corp., York, Pa.

ORDINARILY, ductwork and apparatus casings that are part of air conditioning systems should be constructed of galvanized sheet steel or galvanized copper-bearing metals. For special applications, ducts constructed of other materials such as aluminum, concrete or wood may be used.

In Table 1 is listed recommended gage sizes and joint connections applicable to all normal installations.

Tables 3-6 are presented for convenience in calculating weight of ductwork. Add 15% for the weight of joints and bracing.

Joints and Seams

Rectangular ducts are generally constructed by breaking the corners and grooving the longitudinal seam, using Pittsburgh Lock or Lock Groove, although some fabricators still use the standing seam because of lack of equipment. Elbows and transformation sections are generally formed with Pittsburgh corner seams because this seam is easier to lock in place than the double seam. Complicated fittings are usually constructed with double seam corners as in Fig. 1. For longitudinal seams use any of the following:

Standing seam as shown in Fig. 1. It can be used for the corner of the duct or for joints on any face of the duct. The seam is to be riveted or buttoned on 12-inch centers or less. When at all possible, the standing leg is to be on the outside of the duct unless prohibited by space or other requirements in which special case it may be placed on the inside of the duct.

Pittsburgh lock is shown in Fig. 1. This is for corners only. Other joints are illustrated in this figure.

Lock groove or double seam is for corner construction (double seam) or for joints on the face of the duct (lock groove).

For transverse joint connections refer to Table 1 and Fig. 1.

The end slip may be used wherever S slips are recommended. Where drive slips are used, the end slip may be applied on the narrow side of the duct and the drive slips on the wide side only.

All slips must be at least one gage heavier than the duct material. All laps are to be in the direction of air flow. No sheet metal screws are to be used in ducts when it is possible to use rivets and bolts. All edges and slips must be hammered down so as to leave a smooth finished surface inside the ducts.

It is good practice to solder or calk seams in supply ducts where the static pressure is in excess of 1 inch. If this is not done, allowance should be made for leakage, depending on job conditions.

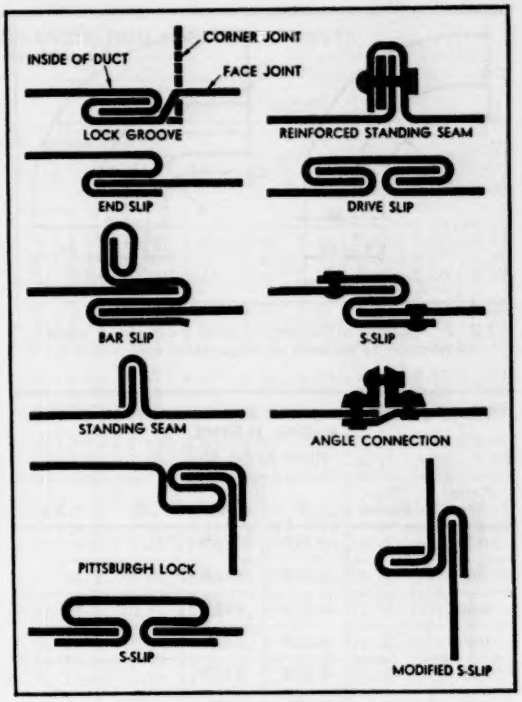


Fig. 1. Arrangements of duct seams and joints.

TABLE 1—GAGE SIZES AND JOINT CONNECTIONS USED IN STANDARD DUCT CONSTRUCTION.

U. S. Std. Gauge	Max. Side Inches	Type of Transverse Joint Connection	Bracing
26	Up to 12	S, Drive, Pocket or Bar Slips on 7′-10″ centers	None
24	13 to 24	S, Drive, Pocket or Bar Slips on 7′-10″ centers	None
	25 to 30	S, Drive, 1″ Pocket or 1″ Bar Slips on 7′-10″ centers	1″ x 1″ x ⅛″ angles 4 ft. from joint
	31 to 40	Drive, 1″ Pocket or 1″ Bar Slips on 7′-10″ centers	1″ x 1″ x ⅛″ angles 4 ft. from joint
22	41 to 60	1½″ Angle Connections or 1½″ Pocket or 1½″ Bar Slips with 1⅜″ x ⅜″ bar reinforcing on 7′-10″ centers*	1½″ x 1½″ x ⅛″ angles 4 ft. from joint
20	61 to 90	1½″ Angle Connections or 1½″ Pocket or 1½″ Bar Slips 3′-9″ maximum centers with 1⅜″ x ⅜″ bar reinforcing	1½″ x 1½″ x ⅛″ diagonal angles or 1½″ x 1½″ x ⅛″ angles 2 ft from joint
18	91 and up	2″ Angle Connections or 1½″ Pocket or 1½″ Bar Slips 3′-9″ maximum centers with 1⅜″ x ⅜″ bar reinforcing**	1½″ x 1½″ x ⅛″ diagonal angles or 1½″ x 1½″ x ⅛″ angles 2 ft from joint

* Duct sections of 3′-9″ may be used with bracing angles outside instead of 7′-10″ lengths with joints indicated.

** Ducts 91″ and larger require special field study for housing and supporting methods.

Elbows and Tees

Elbows and tees should be designed with a throat radius as large as possible, within space limitations, to give minimum pressure loss through the elbow. However, little advantage is to be gained by selecting elbows having a center line radius of more than two duct diameters, as the saving in pressure loss does not warrant it. Where space conditions necessitate the use of short radius elbows, turning vanes should not be used to reduce pressure losses. They are positioned as shown in Fig. 2. Also see Table 2.

When square ells are to be installed they must be equipped with blades as shown in Fig. 3. The upstream edges of blades in elbows should be stiffened as shown. The blades should be installed straight and securely fastened by riveting to the ducts without sheet metal screws or ends of sheet metal projecting into the duct. All raw and sharp edges must be removed from the blades. Blades must be made stiff enough so that they do not rattle or vibrate in the air stream.

Duct Branches

Branch take-offs should always be arranged to cut or slice into the air stream in order to reduce as far as possible the losses in velocity head. Supply duct branches

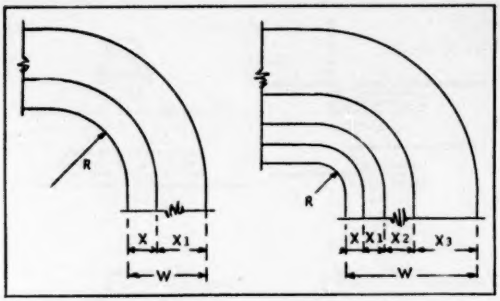


Fig. 2. Positions of turning vanes in short radius elbows. Illustration to be used in conjunction with Table 2.

TABLE 2—POSITIONS OF TURNING VANES IN SHORT RADIUS ELBOWS.

(Refer to Fig. 2)

Ratio R/w	No. Blades	X	X_1	X_2	X_3
0.70	1	0.35W	0.65W		
0.60	1	0.35W	0.65W		
0.50	1	0.35W	0.65W		
0.40	1	0.35W	0.65W		
0.33	1	0.35W	0.65W		
0.30	2	0.2W	0.3W	0.5W	
0.25	2	0.2W	0.3W	0.5W	
0.20	2	0.15W	0.3W	0.55W	
0.15	2	0.15W	0.3W	0.55W	
0.143	2	0.15W	0.3W	0.55W	
0.14	3	0.10W	0.15W	0.25W	0.5W
0.12	3	0.10W	0.15W	0.25W	0.5W
0.10	3	0.10W	0.15W	0.25W	0.5W
0.08	3	0.10W	0.15W	0.25W	0.5W
0.067	3	0.10W	0.15W	0.25W	0.5W

may be of the types shown in Fig. 4 and 5. Branches in return ducts should be of the type illustrated in Fig. 6. Fig. 7 shows the rectangular elbow branch take-off.

Obstructions in Ductwork

Insofar as practical, all piping and obstructions in the path of the duct must be moved to eliminate the possibility of heat transfer from these objects to the air stream as well as the loss in pressure caused by the obstructions. Pipes containing hot water or steam must not pass through the ducts under any conditions. Where obstructions cannot be moved, they must be boxed in with a fitting, streamlined as indicated in Fig. 8. Whenever an obstruction would cause a decrease of more than 15% of the free area of the duct, the duct size must be increased at this point to maintain a constant cross-sectional area to prevent a bad situation.

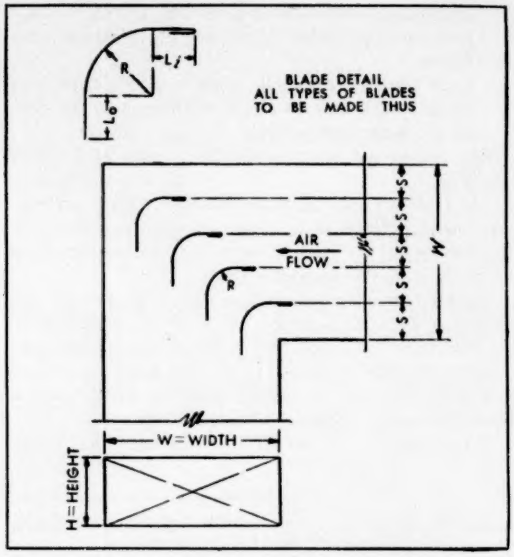


Fig. 3. Location of blades in square ells.

Divide the width of the duct into equal spaces S each $H''/2$, where H is height of duct, $R = 1.4S$, $L_1 = 0.7S$, $L_0 = S$. For example, for a duct 25 inches wide and 10 inches high, $S = 5$ inches, $R = 7$ inches, $L_1 = 3\frac{1}{2}$ inches and $L_0 = 5$ inches.

At *A* of Fig. 8 is illustrated a method of streamlining around obstructions, such as pipe, in a duct. At *B*, details are shown for the streamlined piece to box in a square or irregular shaped section. Included is the formula for calculating dimensions of this shape.

Transition Pieces

Transition pieces should be made with a slope not exceeding 1 to 5 on any side and preferably 1 to 7 wherever possible.

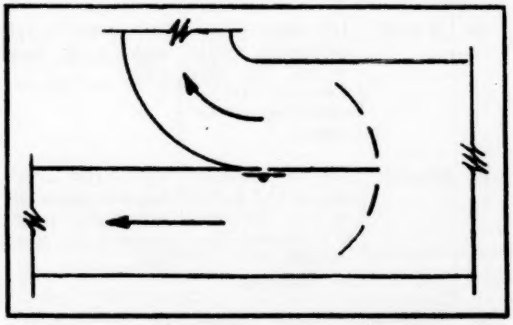


Fig 4. Supply duct branch design.

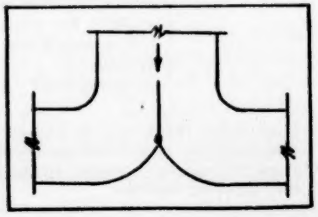


Fig. 5 (Right). Another arrangement for a supply branch.

TABLE 3—WEIGHT PER LINEAR FOOT FOR GALVANIZED IRON RECTANGULAR DUCTS.
U. S. Standard Gage No. 26 and 24.

Size of Duct	26 Gauge—6″ to 12″							24 Gauge—13″ to 22″									
	Long Side of Duct, Inches																
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	Weight of Duct, Pounds per Foot																
6	2.00	2.17	2.34	2.50	2.67	2.84	3.00	4.11	4.34	4.55	4.77	4.98	5.20	5.42	5.64	5.85	6.07
7	2.17	2.34	2.50	2.67	2.84	3.00	3.17	4.34	4.55	4.77	4.98	5.20	5.42	5.64	5.85	6.07	6.29
8	2.34	2.50	2.67	2.84	3.00	3.17	3.34	4.55	4.77	4.98	5.20	5.42	5.64	5.85	6.07	6.29	6.50
9	2.50	2.67	2.84	3.00	3.17	3.34	3.50	4.77	4.98	5.20	5.42	5.64	5.85	6.07	6.29	6.50	6.72
10	2.67	2.84	3.00	3.17	3.34	3.50	3.67	4.98	5.20	5.42	5.64	5.85	6.07	6.29	6.50	6.72	6.94
11	2.84	3.00	3.17	3.34	3.50	3.67	3.84	5.20	5.42	5.64	5.85	6.07	6.29	6.50	6.72	6.94	7.15
12	.....	.....	.....	.....	.....	.....	.....	5.42	5.64	5.85	6.07	6.29	6.50	6.72	6.94	7.15	7.37
14	.....	.....	.....	.....	.....	.....	.....	5.85	6.07	6 29	6.50	6.72	6.92	7.15	7.37	7.59	7.80
16	.....	.....	.....	.....	.....	.....	.....	6.29	6.50	6.72	6.92	7.15	7.37	7.59	7.80	8.02	8.24
18	.....	.....	.....	.....	.....	.....	.....	6.72	6.92	7.15	7.37	7.59	7.80	8.02	8.24	8.45	8.67
20	.....	.....	.....	.....	.....	.....	.....	7.15	7.37	7.59	7.80	8.02	8.24	8.45	8.67	8.89	9.10
22	.....	.....	.....	.....	.....	.....	.....	7.59	7.80	8.02	8.24	8.45	8.67	8.89	9.10	9.32	9.54
24	.....	.....	.....	.....	.....	.....	.....	8.02	8.24	8.45	8.67	8.89	9.10	9.32	9.54	9.76	9.97
26	.....	.....	.....	.....	.....	.....	.....	8.45	8.67	8.89	9.10	9.32	9.54	9.76	9 97	10.20	10.42
28	.....	.....	.....	.....	.....	.....	.....	8.89	9.10	9.32	9 54	9.76	9.97	10.20	10.42	10.64	10.85
30	.....	.....	.....	.....	.....	.....	.....	9.32	9.54	9.76	9.97	10.20	10.42	10 64	10.85	11.06	11.29
32	.....	.....	.....	.....	.....	.....	.....	9.76	9.97	10.20	10.42	10.64	10.85	11.06	11.29	11.50	11.72
34	.....	.....	.....	.....	.....	.....	.....	10.20	10.42	10.64	10.85	11.06	11.29	11.50	11.72	11.90	12.13
36	.....	.....	.....	.....	.....	.....	.....	10.64	10.85	11.06	11.29	11.50	11.72	11.90	12.13	12.35	12.56
38	.....	.....	.....	.....	.....	.....	.....	11.06	11.29	11.50	11.72	11.90	12.13	12.35	12.56	12.78	13.0
40	.....	.....	.....	.....	.....	.....	.....	11.50	11.72	11.90	12.13	12.35	12.56	12.78	13.0	13.20	13.42

TABLE 4—WEIGHT PER LINEAR FOOT FOR GALVANIZED IRON RECTANGULAR DUCTS,
No. 24 Gage.

Size of Duct	Long Side of Duct, Inches																	
	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
	Weight of Duct, Pounds per Foot																	
6	6.29	6.50	6.72	6.94	7.15	7.37	7.59	7.80	8.02	8.24	8.45	8.67	8.89	9.10	9.32	9.54	9.76	9.97
7	6.50	6.72	6.94	7.15	7.37	7.59	7.80	8.02	8.24	8.45	8.67	8.89	9.10	9.32	9.54	9.76	9.97	10.20
8	6.72	6.94	7.15	7.37	7.59	7.80	8.02	8.24	8.45	8.67	8.89	9 10	9.32	9.54	9.76	9.97	10.20	10.42
9	6.94	7.15	7.37	7.59	7.80	8.02	8.24	8.45	8.67	8.89	9 10	9.32	9.54	9.76	9.97	10.20	10.42	10.64
10	7.15	7.37	7.59	7.80	8.02	8.24	8.45	8.67	8.89	9 10	9.32	9.54	9.76	9.97	10.20	10.42	10.64	10.85
11	7.37	7.59	7.80	8.02	8.24	8.45	8.67	8.89	9.10	9.32	9.54	9.76	9.97	10.20	10.42	10.64	10.85	11.06
12	7.59	7.80	8.02	8.24	8.45	8.67	8.89	9.10	9.32	9.54	9.76	9.97	10.20	10.42	10.64	10.85	11.06	11.29
14	8.02	8.24	8.45	8.67	8.89	9.10	9.32	9.54	9.76	9 97	10.20	10 42	10 64	10 85	11.06	11.29	11.50	11.72
16	8.45	8.67	8.89	9.10	9.32	9.54	9.76	9.97	10.20	10.42	10.64	10 85	11.06	11.29	11.50	11.72	11.90	12.13
18	8.89	9.10	9.32	9.54	9.76	9.97	10.20	10.42	10 64	10.85	11.06	11 29	11 50	11.72	11.90	12.13	12.35	12.56
20	9 32	9.54	9.76	9.97	10.20	10.42	10.64	10.85	11 06	11 29	11.50	11 72	11.90	12.13	12.35	12.56	12.78	13.0
22	9.76	9.97	10.20	10.42	10.64	10.85	11.06	11.29	11.50	11.72	11.90	12.13	12.35	12.56	12.78	13.0	13.20	13.42
24	10.20	10.42	10.64	10.85	11 06	11.29	11.50	11.72	11.90	12.13	12.35	12.56	12.78	13.0	13 20	13.42	13.63	13.88
26	10.64	10.85	11.06	11.29	11.50	11.72	11.90	12.13	12 35	12.56	12.78	13.0	13.20	13.42	13.63	13.88	14.08	14.30
28	11.06	11.29	11.50	11.72	11.90	12.13	12.35	12.56	12.78	13.0	13.20	13.42	13.63	13.88	14.08	14.30	14.52	14.72
30	11.50	11.72	11.90	12.13	12.35	12.56	12.78	13.00	13.20	13.42	13.63	13.88	14.08	14.30	14.52	14.72	14.92	15.18
32	11.90	12.13	12.35	12.56	12.78	13.0	13.20	13.42	13.63	13 88	14.08	14.30	14.52	14.72	14.92	15.18	15.38	15.60
34	12.35	12.56	12.78	13.0	13.20	13.42	13.63	13.88	14.08	14 30	14.52	14.72	14.92	15.18	15.38	15.60	15.80	16.02
36	12.78	13.0	13.20	13.42	13.63	13.88	14.08	14.30	14.52	14 72	14.92	15.18	15.38	15.60	15 80	16.02	16.24	16.46
38	13.20	13.42	13.63	13.88	14.08	14.30	14.52	14.72	14.92	15.18	15.38	15.60	15.80	16.02	16.24	16.46	16.68	16.90
40	13.63	13.88	14.08	14.30	14.52	14.72	14.92	15.18	15.38	15.60	15.80	16.02	16.24	16.46	16.68	16.90	17.10	17.32

Bracing and Hangers

All ducts should be braced and stiffened so that they do not breathe, rattle, vibrate or sag. The bracing must be applied on the outside of the duct and may consist of standing seams, reinforced standing seams, modified S slips or angles either with or without cross breaking of the duct panels. All ducts should be securely and permanently hung in a rigid manner. The

TABLE 5—WEIGHT PER LINEAR FOOT FOR GALVANIZED IRON RECTANGULAR DUCTS, No. 22 Gage.

Size of Duct	Long Side of Duct, Inches																		
	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
	Weight of Duct, Pounds per Foot																		
6	12.0	12.25	12.5	12.75	13.0	13.25	13.5	13.75	14.0	14.25	14.5	14.75	15.0	15.25	15.5	15.75	16.0	16.25	16.5
7	12.25	12.5	12.75	13.0	13.25	13.5	13.75	14.0	14.25	14.5	14.75	15.0	15.25	15.5	15.75	16.0	16.25	16.5	16.75
8	12.5	12.75	13.0	13.25	13.5	13.75	14.0	14.25	14.5	14.75	15.0	15.25	15.5	15.75	16.0	16.25	16.5	16.75	17.0
9	12.75	13.0	13.25	13.5	13.75	14.0	14.25	14.5	14.75	15.0	14.25	15.5	15.75	16.0	16.25	16 5	16.75	17.0	17.25
10	13.0	13.25	13.5	13.75	14.0	14.25	14.5	14.75	15.0	15.25	15.5	15.75	16.0	16.25	16.5	16.75	17.0	17.25	17.5
11	13.25	13.5	13.75	14.0	14.25	14.5	14.75	15.0	15.25	15.5	15.75	16.0	16.25	16.5	16.75	17 0	17.25	17.5	17.75
12	13.5	13.75	14.0	14.25	14.5	14.75	15.0	15.25	15.5	15.75	16.0	16.25	16.5	16.75	17.0	17.25	17.5	17.75	18.0
14	14.0	14.25	14.5	14.75	15.0	15.25	15.5	15.75	16.0	16.25	16.5	16.75	17.0	17.25	17.5	17.75	18.0	18.25	18.5
16	14.5	14.75	15.0	15.25	15.5	15.75	16.0	16.25	16.5	16.75	17.0	17.25	17.5	17.75	18.0	18.25	18.5	18.75	19.0
18	15.0	15.25	15.5	15.75	16.0	16.25	16.5	16.75	17.0	17.25	17.5	17.75	18.0	18.25	18.5	18.75	19.0	19.25	19.5
20	15.5	15.75	16.0	16.25	16.5	16.75	17.0	17.25	17.5	17.75	18.0	18.25	18.5	18.75	19.0	19.25	19.5	19.75	20.0
22	16.0	16.25	16.5	16.75	17.0	17.25	17.5	17.75	18.0	18.25	18.5	18.75	19.0	19.25	19.5	19.75	20.0	20.25	20.5
24	16.5	16.75	17.0	17.25	17.5	17.75	18.0	18.25	18.5	18.75	19.0	19.25	19.5	19.75	20.0	20.25	20.5	20.75	21.0
26	17.0	17.25	17.5	17.75	18.0	18.25	18.5	18.75	19.0	19.25	19.5	19.75	20.0	20.25	20.5	20.75	21.0	21.25	21.5
28	17.5	17.75	18.0	18.25	18.5	18.75	19.0	19.25	19.5	19.75	20.0	20.25	20.5	20.75	21.0	21.25	21 5	21.75	22.0
30	18.0	18.25	18.5	18.75	19.0	19.25	19.5	19.75	20.0	20.25	20.5	20.75	21.0	21.25	21.5	21.75	22.0	22.25	22.5
32	18.5	18.75	19.0	19.25	19.5	19.75	20.0	20.25	20.5	20.75	21.0	21.25	21.5	21.75	22.0	22.25	22.5	22.75	23.0
34	19.0	19.25	19.5	19.75	20.0	20.25	20.5	20.75	21.0	21.25	21.5	21.75	22.0	22.25	22.5	22 75	23.0	23.25	23.5
36	19.5	19.75	20.0	20.25	20.5	20.75	21.0	21.25	21.5	21.75	22.0	22.25	22.5	22.75	23.0	23.25	23.5	23.75	24.0
38	20.0	20.25	20.5	20.75	21.0	21.25	21.5	21.75	22.0	22.25	22.5	22.75	23.0	23.25	23.5	23.75	24.0	24.25	24.5
40	20.5	20.75	21.0	21.25	21.5	21.75	22.0	22.25	22.5	22.75	23.0	23.25	23.5	23.75	24.0	24.25	24.5	24.75	25.0
42	21.0	21.25	21.5	21.75	22.0	22.25	22.5	22.75	23.0	23.25	23.5	23.75	24.0	24.25	24.5	24.75	25.0	25.25	25.5
44	21.5	21.75	22.0	22.25	22.5	22.75	23.0	23.25	23.5	23.75	24.0	24.25	24.5	24.75	25.0	25.25	25.5	25.75	26.0
46	22.0	22.25	22.5	22.75	23.0	23.25	23.5	23.75	24.0	24.25	24.5	24.75	25.0	25.25	25.5	25.75	26.0	26.25	26.5
48	22.5	22.75	23.0	23.25	23.5	23.75	24.0	24.25	24.5	24.75	25.0	25.25	25.5	25.75	26.0	26.25	26.5	26.75	27.0

TABLE 6—WEIGHT PER LINEAR FOOT FOR GALVANIZED IRON RECTANGULAR DUCTS, No. 20 Gage.

Size of Duct	Long Side of Duct, Inches															
	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	
	Weight of Duct, Pounds per Foot															
6	19.9	20.4	21.0	21.6	22.1	22.8	23.4	23.9	24.5	25.1	25.7	26.3	26.7	27.4	28.0	
8	20.4	21.0	21.6	22.1	22.8	23.4	23.9	24.5	25.1	25.7	26.3	26.7	27.4	28.0	28.6	
10	21.0	21.6	22.1	22.8	23.4	23.9	24.5	25.1	25.7	26.3	26.7	27.4	28.0	28.6	29.2	
12	21.6	22.1	22.8	23.4	23.9	24.5	25.1	25.7	26.3	26.7	27.4	28.0	28.6	29.2	29.8	
14	22.1	22.8	23.4	23.9	24.5	25.1	25.7	26.3	26.7	27.4	28.0	28.6	29.2	29.8	30.4	
16	22.8	23.4	23.9	24.5	25.1	25.7	26.3	26.7	27.4	28.0	28.6	29.2	29.8	30.4	30.9	
18	23.4	23.9	24.5	25.1	25.7	26.3	26.7	27.4	28.0	28.6	29.2	29.8	30.4	30.9	31.5	
20	23.9	24.5	25.1	25.7	26.3	26.7	27.4	28.0	28.6	29.2	29.8	30.4	30.9	31.5	32.1	
22	24.5	25.1	25.7	26.3	26.7	27.4	28.0	28.6	29.2	29.8	30.4	30.9	31.5	32.1	32.7	
24	25.1	25.7	26.3	26.7	27.4	28.0	28.6	29.2	29.8	30.4	30.9	31.5	32.1	32.7	33.3	
26	25.7	26.3	26.7	27.4	28.0	28.6	29.2	29.8	30.4	30.9	31.5	32.1	32.7	33.3	33.9	
28	26.3	26.7	27.4	28.0	28.6	29.2	29.8	30.4	30.9	31.5	32.1	32.7	33.3	33.9	34.4	
30	26.7	27.4	28.0	28.6	29.2	29.8	30.4	30.9	31.5	32.1	32.7	33.3	33.9	34.4	35.0	
32	27.4	28.0	28.6	29.2	29.8	30.4	30.9	31.5	32.1	32.7	33.3	33.9	34.4	35.0	35.6	
34	28.0	28.6	29.2	29.8	30.4	30.9	31.5	32.1	32.7	33.3	33.9	34.4	35.0	35.6	36.2	
36	28.6	29.2	29.8	30.4	30.9	31.5	32.1	32.7	33.3	33.9	34.4	35.0	35.6	36.2	36.8	
38	29.2	29.8	30.4	30.9	31.5	32.1	32.7	33.3	33.9	34.4	35.0	35.6	36.2	36.8	37.3	
40	29.8	30.4	30.9	31.5	32.1	32.7	33.3	33.9	34.4	35.0	35.6	36.2	36.8	37.3	37.9	
42	30.4	30.9	31.5	32.1	32.7	33.3	33.9	34.4	35.0	35.6	36.2	36.8	37.3	37.9	38.5	
44	30.9	31.5	32.1	32.7	33.3	33.9	34.4	35.0	35.6	36.2	36.8	37.3	37.9	38.5	39.0	
46	31.5	32.1	32.7	33.3	33.9	34.4	35.0	35.6	36.2	36.8	37.3	37.9	38.5	39.0	39.6	
48	32.1	32.7	33.3	33.9	34.4	35.0	35.6	36.2	36.8	37.3	37.9	38.5	39.0	39.6	40.2	
50	32.7	33.3	33.9	34.4	35.0	35.6	36.2	36.8	37.3	37.9	38.5	39.0	39.6	40.2	40.8	
52	33.3	33.9	34.4	35.0	35.6	36.2	36.8	37.3	37.9	38.5	39.0	39.6	40.2	40.8	41.4	
54	33.9	34.4	35.0	35.6	36.2	36.8	37.3	37.9	38.5	39.0	39.6	40.2	40.8	41.4	42.0	

hangers used must not pass through, or be inside, the duct. When vertical ducts pass through floors they should be supported by angles riveted to the duct and resting on the floor. This provides suitable support.

Refer to Fig. 9 for commonly used methods and devices for hanging ducts. *A* of this illustration de-

TABLE 7.—LENGTH OF GALVANIZED IRON STRIP TO PROVIDE STREAMLINED COVER FOR PIPE.
(For arrangement of pipe cover, see Fig. 8)

Item	Diameter of Pipe to be Covered, Inches											
	1	1½	2	2½	3	3½	4	5	6	8	10	12
Length of Strip, Inches	4¾	7	10	11¾	14¼	16¾	19	23¾	28½	37½	47¼	57

NOTE: Whenever a pipe or other obstruction passes through a duct, the size of the duct is not increased unless the obstruction takes up more than 15% of the area. In every case an easement must be used as shown.

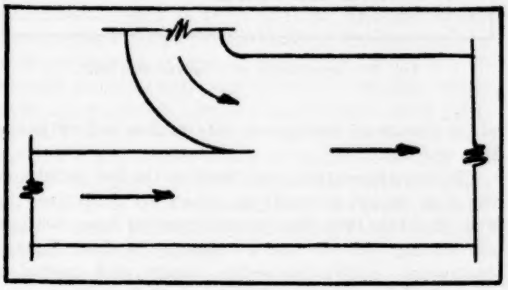


Fig. 6. Branch in return duct.

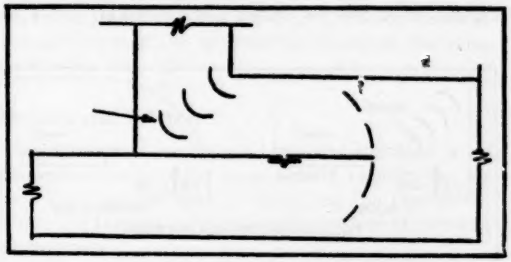


Fig. 7. Rectangular elbow branch take-off.

picts three separate methods of hanging ducts from an I-beam. At *B* is illustrated a method of hanging a duct beneath concrete ceiling or floor. The hanger inserts were put in before the cement was poured. At *C* is shown a hanger insert and also a hole drilled through the concrete for the application of an angle iron, washers or a flat piece of steel. A clamping device, which enables one to pull the duct tight up against a wooden ceiling, stud or rafter, is shown at *D*. At *E* is a toggle bolt that is used to fasten a duct.

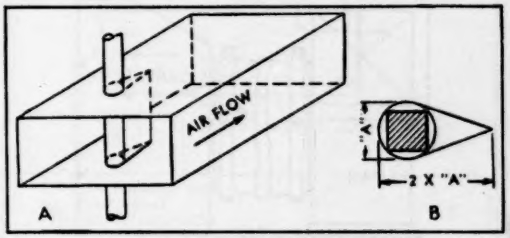


Fig. 8. Streamlining for boxed obstructions.

Fan Connections

Canvas connections (asbestos cloth, if there is a fire hazard) must be provided and installed on both the inlet and discharge side of all fans. The canvas used should not be less than 10 oz doubled. Connections are illustrated in Fig. 10.

Poor inlet connections will impair fan performance more than correspondingly poor outlet connections. It is therefore necessary to make the inlet connections without obstructions and in such a manner that the air can flow freely and easily into the fan inlet without any abrupt changes in direction of air flow. Sharp turns and uneven flow often cause the fan to be noisy. The minimum width of the inlet is 50% of the fan wheel diameter, but 100% is preferable. When the

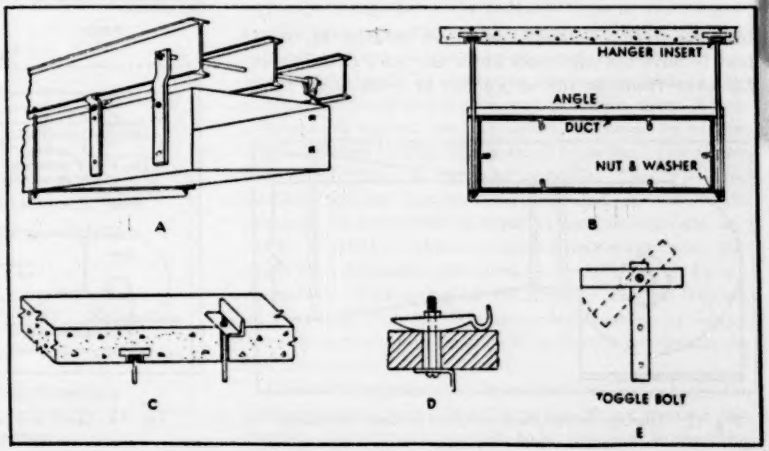


Fig. 9. A number of methods for supporting ducts.

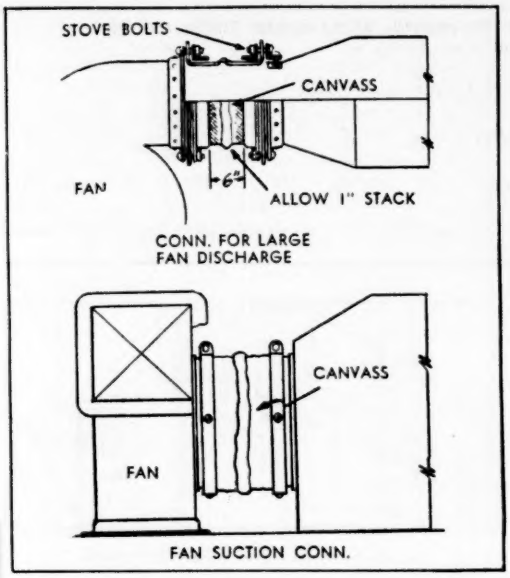


Fig. 10. Canvas connection to ducts installed on inlet and discharge side of fans.

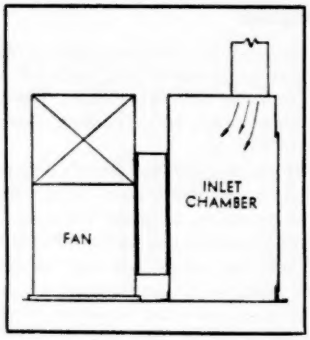


Fig. 11. Connection from a large inlet chamber to fan.

inlet connection in large, as shown in Fig. 11, it is best to have the inlet duct enter the inlet chamber as far away from the fan as possible in order to give the

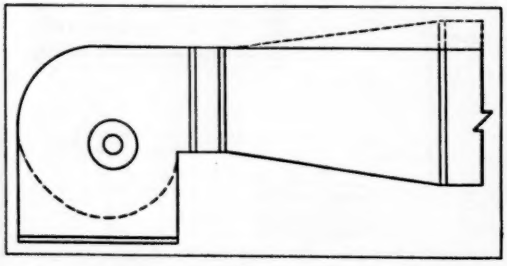


Fig. 12. Transformation piece installed between fan outlet and duct.

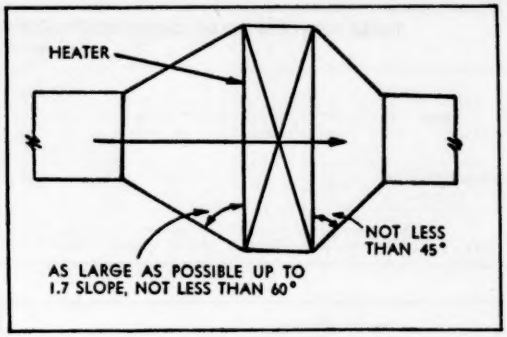
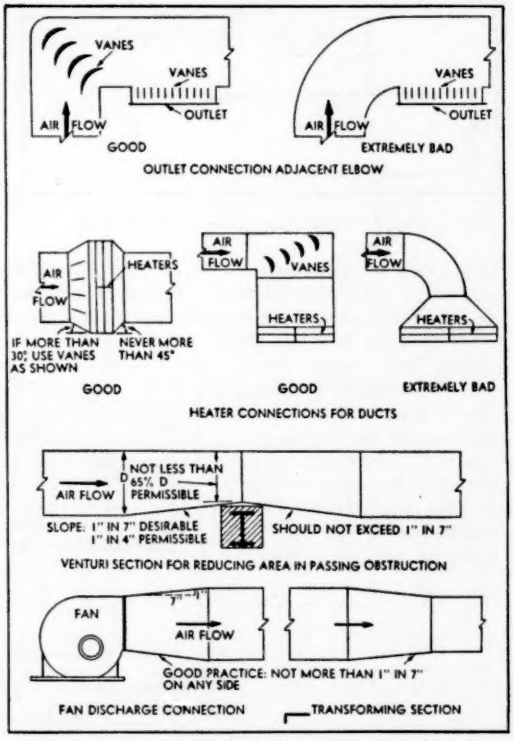


Fig. 13. Installation of a heater in a duct.

air a chance to straighten out its flow before going into the fan.

The transformation piece between the fan outlet and the duct should be made as shown by solid lines in Fig. 12 rather than that shown by dotted lines, because air leaving the fan has a tendency to flow slightly downward. Outlet connection design will depend a great deal on job characteristics and limitations.

A centrifugal fan always requires a discharge duct. The duct should be at least as long as the largest dimension of the fan outlet and preferably twice as



Courtesy, Modern Air Conditioning, Heating and Ventilating

Fig. 14. Good and bad practice for installing heater connections for ducts.

long. It is never good practice to reduce the area of the discharge connection to less than that of the fan outlet area.

Heater Connections

When heaters are installed in ductwork, the heater casing may be as shown in Fig. 13. More details of good and bad practice are illustrated in Fig. 14.

Outside Air Intakes and Exhaust Openings

Avoid locating outside air intakes near sources of contamination such as areas of fume, odor and smoke concentrations. High intake locations are desirable to avoid drawing in ground or street dirt. Avoid use of sidewalk grilles or basement windows as intakes. Penthouse and gooseneck intakes should extend above parapet walls so dust and fly ash that has settled on roof surfaces is not readily blown by wind action into the intake. Locations in pits and narrow areaways are undesirable, as duct concentrations are high at such places. Avoid possible contamination from chimneys, kitchen or toilet exhausts.

All outside air intakes and exhaust openings should be provided with screens of mesh not exceeding 1 inch and with suitable means for preventing rain and snow from passing through. Large wall openings can be fitted with louvers as shown in Fig. 15; small openings through the roof can be fitted as shown in the same illustration.

Dampers and Splitters

No matter how carefully a duct system is sized, some means must be provided to accurately regulate the air flow. This may be done by providing the supply, the return and the exhaust ducts with a system of dampers and splitters.

Supply duct branches should be furnished with splitters as shown in Fig. 7, which must be long enough to completely close off the air to the branch. They therefore should be made the width of the branch duct opening plus 10%. The upstream edge of the splitter may be treated as indicated in Fig. 3. The splitter must be fabricated of material heavy enough so as not to flutter or vibrate in the air stream.

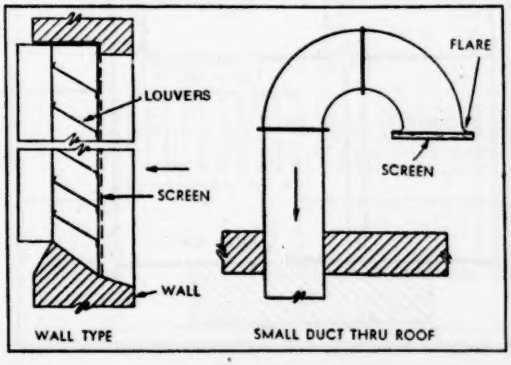


Fig. 15. Outside air openings.

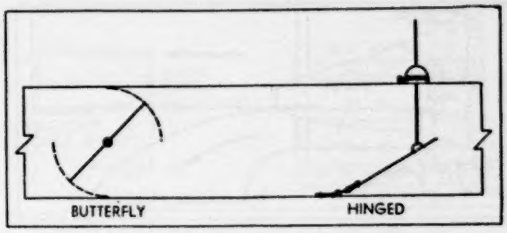


Fig. 16. Two types of dampers commonly used.

Fig. 17. Damper placed near outlet.

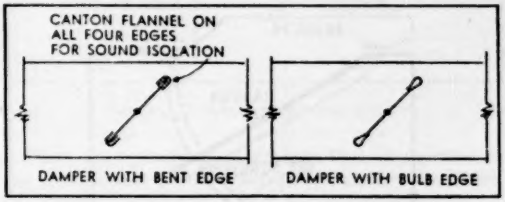


Fig. 18. How edges of dampers are treated.

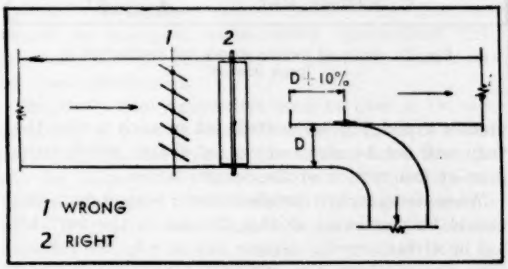


Fig. 19. Installation of damper near a branch duct.

Dampers may be of the butterfly type or the hinged type as shown in Fig. 16. Dampers are to be used in exhaust and return ducts in place of the splitters described and are to be located as near as possible to the junction between the branch and the main duct. When a damper is located near an outlet, it should be of the type as shown in Fig. 17, in order to disturb the direction of air flow as little as possible. "Santrols" or similar louvered dampers may be used for the same purpose. If a butterfly damper is used to regulate the air to a grille, it must be placed upstream from the grille by a distance equivalent to a minimum of 4 duct diameters. Both edges of the damper may be treated as shown in Fig. 18. The dampers must be of heavy enough construction so as not to flutter or vibrate in the air stream.

It is very important to have tight fitting outside air dampers so as to avoid infiltration of air around the damper. Louver dampers are to be installed so that the

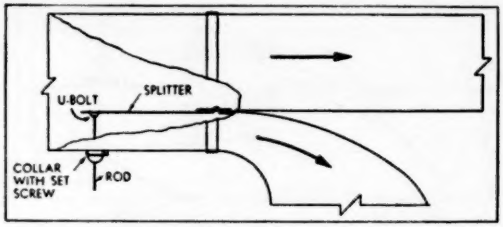


Fig. 20. Arrangement for operating damper outside duct.

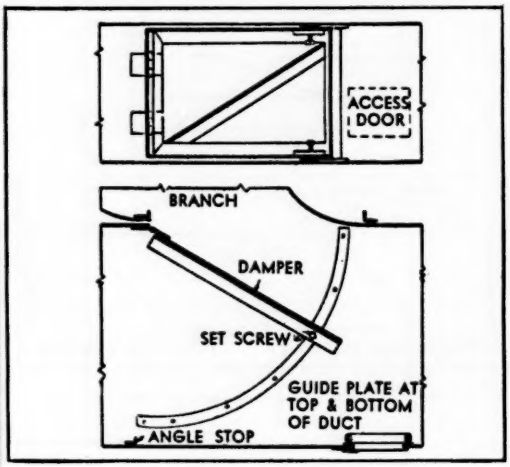


Fig. 21. Built-up locking device for installation in large damper.

frames are rigidly supported, yet in such a way that they will not be strained out of shape, which would prevent free motion of the damper leaves.

When dampers are installed near a branch duct, they should be positioned so that the air in the duct will not be divided by the damper but only by the splitter. This arrangement plus splitter proportions is shown in Fig. 19.

Accessible means must be provided for operating all hand dampers and splitters from outside the duct. This can be done by standard damper quadrants or other approved means such as shown in Fig. 16 and 20. Dampers and splitters must be securely fastened to pivot rods and operating linkage so that there is no vibration or rattling. The pivot rod must be securely fastened so as not to come loose later and it should pass through fittings where the rod goes through the duct. Fittings must be fixed to the duct by stove bolts or rivets. Sheet metal screws should not be used as they tend to loosen. The pivot rod should be cut off neatly at the ducts so that they do not project unnecessarily. For very large dampers or splitters, it may be necessary to use a built-up locking device as shown in Fig. 21.

When ducts pass through fire walls, fire dampers must be installed as required by the Underwriters and the local ordinances. A suggested fire damper is illustrated in Fig. 22.

Exhaust Systems

All toilet exhaust ducts must be tight. Where they pass through occupied spaces they must be soldered. Exhaust ducts from kitchens and other sources of hot and moisture laden air must be soldered where they pass through any space where drippage of water from the duct would be objectionable.

Access Openings

Access must be provided to all parts of the duct system large enough for a man to crawl through. If access is not provided by other suitable means, inspection doors not less than 12-inch x 15-inch in dimension must be installed. Openings must be provided to any automatic dampers or thermostats which require inspection and service.

There must be access to all fans, fan housings and motors located in the system. Doors must be installed in at least one side of the heaters set in the ductwork.

Access doors at least 16-inch x 24-inch should be provided on both sides of air washers, cooling coil banks, preheaters, reheaters and air filters. All access doors and other inspection openings located on the discharge side of the fan must be hinged so that they tend to close when hit by the air stream. They must be fitted with a felt gasket or stripping to prevent air leakage around the opening. All access doors and openings must be substantially constructed and so fastened that they do not vibrate or rattle. They must be provided with a locking device so that the door can be operated from inside or outside the duct or casing.

Duct Construction Noise Control

Noise created by ducts is caused when air passes over obstructions such as heaters, filters, projecting duct seams and joints, grilles, splitters, and from fan

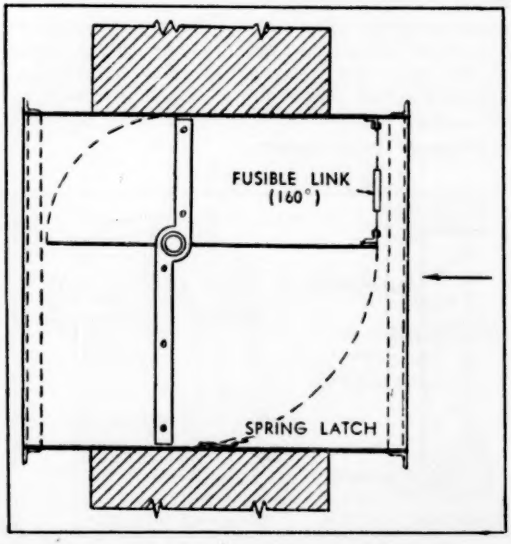


Fig. 22. Suggested design for fire damper.

vibration and noise. It increases in intensity with increases in air velocity. Other causes are noises between rooms connected by the same duct system, outside noise and building vibration.

Ducts should be made as smooth as possible inside and the number of projecting screws and sheet metal bends should be minimized. Avoid all raw edges on seams, splitters, etc., as well as all direction connections of moving machinery, such as fans and motors, to the ducts. Reduction of noise transmission through the air is accomplished by installing sound-absorbent material in or along the path of air flow. On some jobs where connections are short and it is impossible to install enough sound-absorbent material by lining the duct, baffles may be placed as illustrated in both Fig. 23 and 24.

The internal duct area should not be reduced more than 15% by sound insulation due to the excessive air velocity which might result.

Requirements for good sound-absorption material are:

(1) High absorption at low frequencies.
(2) Adequate strength to avoid breakage.
(3) Fire resistance and compliance with national and local code requirements.
(4) Low moisture absorption.
(5) Freedom from attack by bacteria and algae.
(6) Low surface coefficient of friction.
(7) Particles should not fray off at the higher duct velocities.
(8) Freedom from odor when either wet or dry.

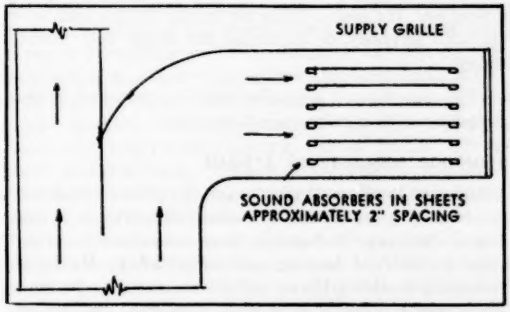


Fig. 23. Baffles for deadening sound in ducts.

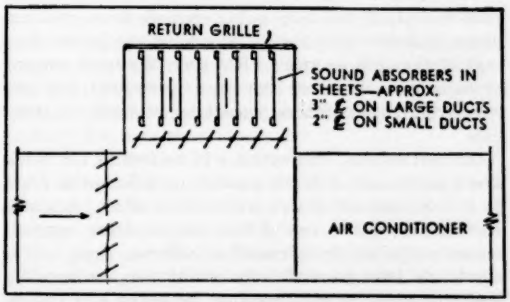


Fig. 24. Another method for using baffles.

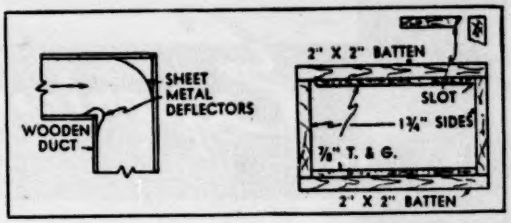


Fig. 25. Wooden elbow provided with deflectors.

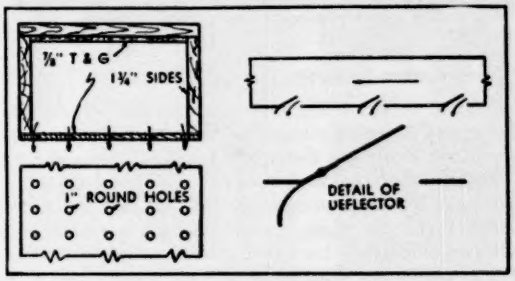


Fig. 26. Details of small wood duct.

There are numerous cases where it is impractical to use sheet metal ducts. Therefore, masonry, concrete, tile, wood or special materials are used instead.

Where corrosion is bad or where the humidity is high, as in chill rooms, ducts constructed of wood or special materials are recommended. Such materials should be fireproof, verminproof, mouldproof, free from odor and not subject to deterioration from water or vapor penetration.

Relatively heavy materials must be used in the construction of wooden ducts. For large ducts, 1¾-inch material is customary; and for smaller ones, the sides can be made of 1¾-inch material and the top and bottom of ⅞-inch T&G lumber. Cypress, redwood or other first-class wood that will not warp is recommended. Wooden elbows should be provided with deflectors as shown in Fig. 25 or with blades as previously described for sheet metal elbows. The inside of the ducts should be as smooth as possible and all battens should be on the outside. Details of construction are shown in Fig. 25 and 26.

Outlets may be either square or consist of round holes usually about 1 inch in diameter using a deflector as shown in Fig. 26.

Where concrete, brick or tile ducts are used, careful consideration must be given to air breakage and transmission losses. The inside surface must be made tight by sealing all cracks and crevices with some material such as plaster and oil paint. A tight joint must be made between sheet metal ducts and concrete or masonry ducts. It can be done by nailing the sheet metal duct to a wooden strip placed in the concrete, or by other convenient means. The heat loss through underground concrete ducts is usually so large that it must be figured as a part of the load. Insulation should be applied where necessary. Underground ducts should have ample access openings and be supplied with drains.

Experience is my Classroom

By T. W. REYNOLDS

EDITOR'S NOTE. Mr. Reynolds continues the subject of servicing, trouble jobs, maintenance and similar problems.

Service from Salesmen

While we are on the subject of service, I would like to put in a word for engineers who, like myself, could well use more and better service from the seller of the product the engineer specifies. It is most annoying to call up a manufacturer and be told that the salesman is in the regular weekly sales conference and cannot be reached for a half day or more. Next week he is out in the West at some sales convention, or is giving their factory the once-over. You gain the impression that sales research is an end in itself, for no one seems to be interested in the firing line.

A particular salesman from each company is assigned to your office. If he isn't available try to get another one. The girl in his office wants to know if she can take care of the question and what job your question relates to. You explain that it's only a hypothetical question relating to things in general which any salesman present can answer. She has to have your name in full, together with the name, address and telephone number of your firm, all of which the salesman must know for he has had them in his memory for years. If your firm's name is other than Smith you have a trying time in spelling it several times over for her, but this is all a good modern business method, saving the salesman's time at the expense of your own. After going through all this on many occasions with the same company whose telephone lady still has no recollection of who you are or whom you are associated with, you may wait a couple of days, even a week or more, before the call is answered. Sometimes several calls have to be made. When many calls are made to many companies in the course of a day, you find it all annoying and begin to think about your vacation.

Just about the time that the salesman regularly assigned to you grows accustomed to your peculiarities and you to his, the company he is with assigns him to other territory, or he quits for other fields, and is soon back trying to sell you some competitive product he formerly condemned. For some reason, there is too much turnover of salesmen. Regardless of who he is, he may evidence too much greed in worrying about your specifications instead of your wants, when if he would only take care of the latter you would be grateful to remember him in the former, but he is interested in your next job and not the past job. Even when he is inclined to be helpful, his catalog department hamstrings him by having nothing available for many months. When the literature does arrive it is far from telling a quick and complete story; but this is a subject in itself, one I would like to cover some other time.

Another bit of sales procedure that is annoying for one who handles construction projects all over the country, is the custom of the manufacturer in allowing their representative who calls on you only 10% of the sales on a job out of his territory. Sometimes it is not even 10%, but merely honorable mention. Your local representative then loses interest in you and so does the distant representative where the job is located, since he sells only to his local contractor. Yet he would not be selling to this contractor except for your specifications. Quite likely the contractor never used his product before. Trying to get the near and remote agencies to cooperate in securing information for you is often a trial, as neither agency is interested in the other.

In closing, let me record that this final bit of analysis is far from true for many a salesman or manufacturer. It is intended to be constructive for those who are as described. We blame labor for many things, but service with anybody or anything has badly deteriorated today.

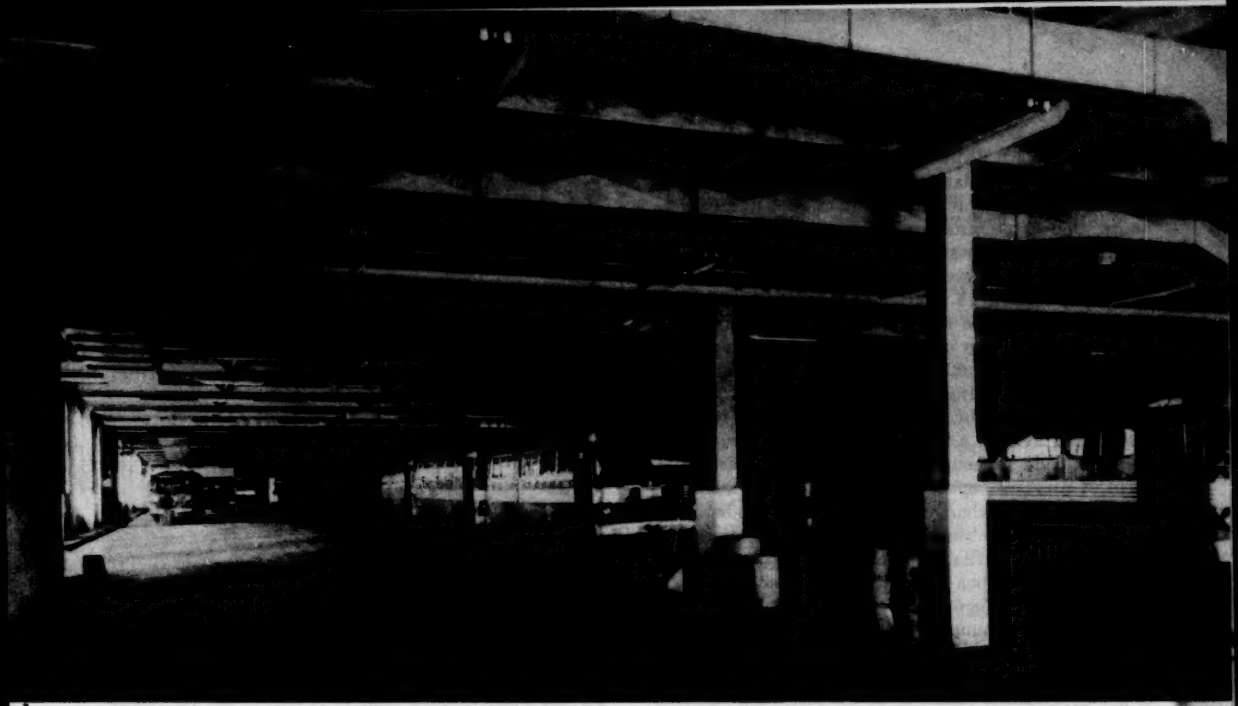
(The question of servicing will be continued in this department in a subsequent issue.)

• INDOOR HUMIDITY IN A HOME

Someone has been trying to get the writer too deeply involved in a discussion of indoor humidity in a residence, claiming it depends to a considerable extent upon the kind of heating system installed. Maybe he has got something there, but there seems to be room for so much discussion on this point that the writer, in the absence of conclusive tests, will tread carefully and will be content with the following observation:

The relative humidity in a heated residence (barring the usual moisture gain, such as from cooking, plants and the body) will, of course, be lower than that of the outdoor space. However, the total amount of moisture (therefore the vapor pressure) will not vary from that outdoors, except by internal moisture gain.

Infiltration and exfiltration will be less as the stack effect decreases. A low temperature differential from floor to ceiling will create a low stack effect. A warm air heating system can deliver air at lower temperatures as the air is increased in volume. Such a system would have a low floor to ceiling temperature differential. Fuel would therefore be saved and indoor humidity might be increased.



CO Control in Bus Garages

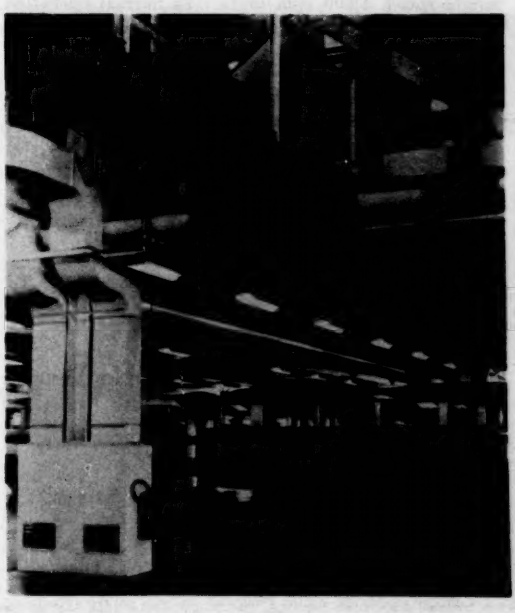
PROTECTION of workmen against carbon monoxide fumes in four new bus garages of New York City's Transit System is achieved through the use of two types of ventilation control arrangements, both equally as effective and both relying upon the same kind of CO detecting and alarm instruments.

The garages, housing diesel and gasoline powered buses, are located in Flushing, Staten Island, Ulmer Park, and Flatbush. All are approximately the same size, each containing some 140,000 sq ft of floor area with storage facilities for 200 to 250 buses.

Since carbon monoxide gives no warning, it can strike before its victim is aware of anything wrong. Even when concentrations are so low that no dramatic physiological effects are noticeable, carbon monoxide causes mental apathy and physical loginess resulting in worker inefficiency and susceptibility to accidents. The hazards of carbon monoxide can be overcome by continuous ventilation, but usually this is an expensive method, especially in the winter when heating costs have to be considered. Therefore, a reliable ventilation control system has proved to be the most economical and efficient way of safeguarding garage workmen against this hazard.

At the Flatbush and Ulmer Park garages, the heating and ventilating systems are integral. Supply and exhaust fans and steam heating coils are installed in two sheet metal equipment houses in the roof trusses of the garages, with ductwork transporting fresh, and recirculated air. Since both these garages are essentially the same design, a description of one will suffice.

The garage area is divided into five zones, each served by an independent heating-ventilating system. One zone is the fuel dispensing area, cut off from the rest of the building by fire walls and automatic fire doors. This area is supplied with 100% fresh air.



Air discharge openings in three of five zones are at floor level.

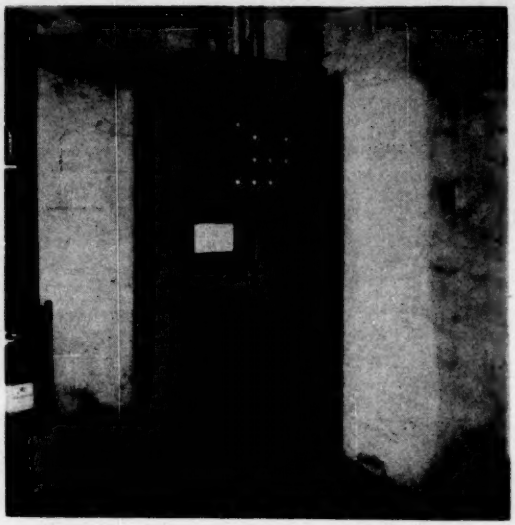
The other four zones are arranged to receive 10 to 15% fresh make-up air at all times. Through a program clock control, the systems automatically change from partial recirculation to 100% fresh air once every hour for about 10 minutes. In addition, during peak hours, these systems operate on 100% fresh air.

Superseding all other controls are sensitive carbon monoxide alarms, developed by the Mine Safety Appliances Co., Pittsburgh. These instruments continuously sample and test the atmosphere in return air ducts. If the concentration of carbon monoxide exceeds two parts in 10,000 (.02%), the system automatically switches to ventilating position. Using about 100 watts of electrical current, these alarms provide vigilant monitoring against a build-up in concentration of carbon monoxide without the wasteful, make-sure expedient of constant ventilation. Therefore, at these two garages, four air changes per hour are provided automatically, with the stand-by assurance that the alarms will start the ventilating cycle if any excessive concentrations of carbon monoxide are present.

As a further safeguard, a manual pushbutton control for the fresh air supply is installed in the area where buses are repaired. If the men in this area feel they need additional fresh air, they merely push a button to get it. Exhaust fumes from the buses are removed from the area through flexible metal hose connections to tail pipes. Discharge of this exhaust is into an underground duct system.

Supply air, fresh or recirculated, is transported from the fan houses through ducts led down the building columns. Discharge outlets of these ducts are about one foot above the floor. Louver blades in the outlets are set to swirl the air as it leaves.

Supply fan motors in four zones are two-speed units arranged for operation at 1,800 rpm, full capacity, or at 1,200 rpm low speed. The exhaust fan motors are single speed, 1,800 rpm units. In normal operation, the supply fans run at 2/3 speed, the exhaust fan is



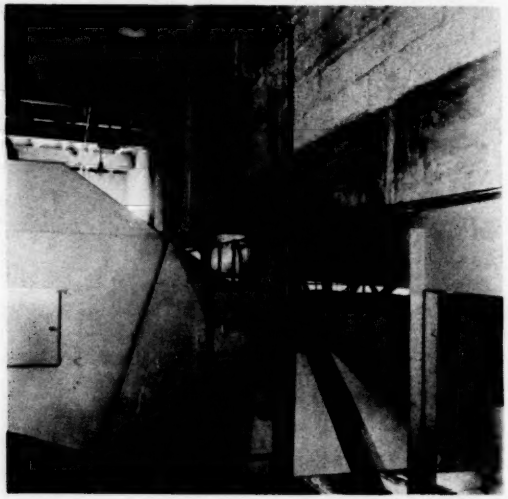
Master control and indicator panel is under 24-hour supervision.

off, the main exhaust damper is closed, the recirculating air damper is open and the fresh air damper is closed. The exhaust and recirculation dampers are components of a two-position, multi-louvered mixing damper. When the CO alarms, the program timer, or the manual switch call for air changes, the supply fan goes on full speed, the exhaust fan operates at full speed, the exhaust damper opens, the recirculation damper closes and the fresh air intake damper opens. The detecting instruments are located in the fan booths.

Air samples are drawn into the instruments by small blowers connected to 1/80 horsepower motors. The sample is forced through a cell containing thermocouples and a catalyst, active hopcalite. Catalytic reaction of this chemical converts carbon monoxide to carbon dioxide. This reaction liberates heat which is measured by the thermocouples and indicated on a contacting meter. When the needle of the meter reaches a predetermined setting (.02%), a magnet pulls it to a stop post, closing the alarm circuit. The magnet holds it against the post continuing the circuit until a solenoid reset switch is operated automatically after the CO content of the sampled atmosphere is reduced to a safe concentration. Closing the contacting meter circuit energizes a secondary relay to the ventilation control system.

A master control and indicating panel for the entire ventilating system is located in the tool room of the bus garage which is under 24-hour observation.

At the Flushing and Staten Island garages, the heating and ventilating systems are independent of each other. Truss-mounted unit heaters take care of the heating, while individual roof fans handle the ventilating requirements. The roof fans are controlled automatically by the same type of MSA carbon monoxide alarms that are used in the other garages. In all, there are 27 alarms strategically located in each garage. Each alarm samples the atmosphere within a radius of 40 feet.



Carbon monoxide alarm mounted on wall above return air duct tests for CO in continuous sample.

Reflective-Type Pipe Insulation Tested at Navy Station

Tests were conducted at the U. S. Naval Engineering Experiment Station at Annapolis on a reflective-type, thermal pipe-insulation to evaluate insulating properties and serviceability for the temperature range of 200F to 800F. Full text of the report is in E.E.S. Report 1H51806, prepared by R. B. Plate of the Materials Branch.

THE Office of Chief of Engineers, Department of the Army was interested in the use of reflective-type, thermal insulation for pipe lines. At their request, the station performed a laboratory study of the material.

A manufacturer supplied three samples of reflective-type insulation. The thermal insulating properties of these samples and some of their combinations were determined by standard procedures and compared with those of materials used by the Navy. In the course of mounting and dismounting these samples for laboratory tests, general information was gained regarding the serviceability of this type pipe insulation.

Description of Insulation

This insulation is composed of concentric cylindrical layers of bright aluminum alloy sheet enclosed in an outer protective casing. The inner layers are spaced approximately ½ inch apart and held in circular shape by means of slotted end supports and between-layer spacers. Spacers are cemented to the layers and to the outer casing. The end supports are cemented to the outer casing but not to the inner layers. The samples furnished for test were 30 inches long and of the following dimensions:

Sample	Inner Diam., Inches	Thickness, Inches	Thickness Gage of Metal Sheet	
			Inner Layer	Casing
A	3½	1	36	30
B	3½	1½	30	20
C	5½	2½	30	20

Thermal Properties

The insulating properties of this material depend primarily upon the reluctance of a bright surface to absorb and to radiate heat. The efficiency also depends in part on the opposition to convection currents presented by the confined air spaces formed between adjacent layers of metal. Because of the reluctance of a bright metal surface to radiate the heat transmitted

Fig. 1. (Right) Heat loss vs. temperature difference.

Legend

Conventional Insulation.

(1) Standard density; to 500F, 1 inch thick.

(2) Same; 1.5 inches thick.

(3) Compounded; to 1,000F; 1.5 inches.

(4) Compounded; 500 to 1,000F; 3.6 inches; double layer.

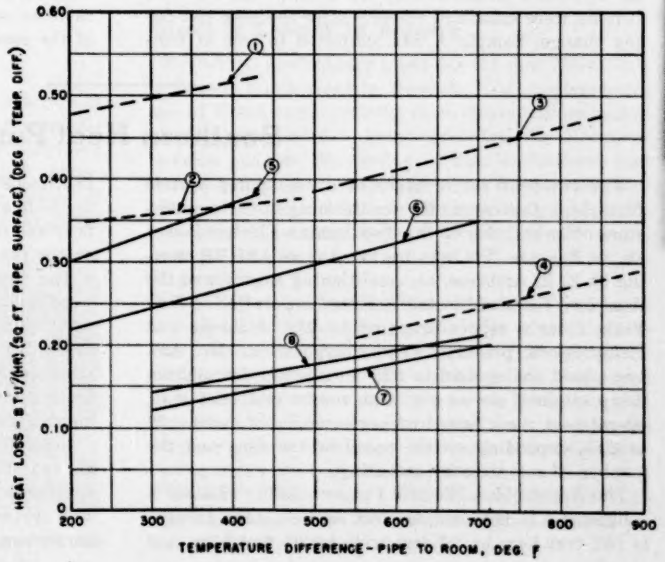
Reflective Insulation

(5) Sample A.

(6) Sample B.

(7) Sample C.

(8) Sample C covered with .07 inch asbestos cloth.



to it, outer surface temperatures higher than those of conventional materials may be expected.

Thermal-insulating properties were determined on the Station's pipe testing apparatus. The results of the test and a comparison between the various thicknesses of the material and corresponding thicknesses of some of the grades of conventional insulation covered by Navy Specification 32P8d are plotted on Fig. 1. The results shown for the conventional materials were obtained from actual tests and represent those materials that are well within the specified limits.

The outer surface temperatures of the three thicknesses tested are relatively high in comparison with the temperatures of conventional materials. This high outer-surface temperature indicates that there is a difference in the method of heat dissipation as compared with that of conventional materials. With the reflective-type insulation, heat loss by radiation is much lower than by convection; while with conventional types, radiation losses are slightly higher than by convection.

In order to reduce the relatively high outer-surface temperatures, a single layer of an approved asbestos cloth (0.07 inch thick) was secured over and around the outer periphery of Sample C. The outer surface temperature of this installation was 20 and 30 degrees lower than the uncovered Sample C at temperature differences of 500F and 700F, respectively. The cloth-covered surface has a much higher emissivity than the bare bright-metal surface and consequently caused an increase in heat loss by radiation and a decrease by convection. This change in surface characteristics and slight increase in thickness resulted in an increase in total heat loss of approximately 10%. Ordinarily such a slight change would not be perceptible, but with the highly accurate automatic control and measuring equipment used in conjunction with this test, the slightest change can be observed and reproduced readily.

Because the efficiency of the material depends upon the reflective properties of its bright surfaces, the samples were examined visually after the pipe test for any change. Sample A was subjected to test at temperatures up to 400F for approximately 2 weeks and then as an inner layer in conjunction with Sample C, at temperatures up to 800F for approximately 4 weeks. The inner and outer surfaces of the inner layer became slightly oxidized. In spite of the oxidation, the surfaces still retained a relatively bright luster. The surfaces of Sample B which was subjected to test at temperatures up to 700F, were found to be unchanged.

Structural Properties

The Station was not asked to study the structural properties of the material; however, a number of defects that may be considered objectionable were observed. The outer casing of Sample A was of a lighter gage metal than Samples B and C and consequently was not capable of withstanding rough handling. When removed from the test pipe, the end supports of Sample A and most of the center layer spacers of all three samples tested either came loose or the cement had darkened and the spacers were easily separated from the metal. In fact, when Sample A was removed it separated at all the cemented areas and could not be used again. Because of the cement failure, the stability of the material under vibration could not be determined.

The manufacturer is cognizant of the cement failure and has indicated that the spacers and end supports can be attached mechanically with small screws.

Conclusions

Reflective-type insulation has heat insulating properties comparable to or better than conventional materials in the temperature range from 200 to 800F. The outer-surface temperatures are higher than those of conventional materials of corresponding thicknesses. By applying an asbestos-cloth cover over the outer metal surface the high surface temperatures can be reduced satisfactorily with only a slight increase in total heat loss. The cement used for securing the end supports and spacers is unsatisfactory. A mechanical fastener such as small screws could be used in place of the cement.

Southern Heat Pump

The two-year performance of a heat pump system furnishing year-round air conditioning in the new six-story office building of the Appalachian Electric Power Co., at Roanoke, Va., was described at an ASHVE meeting by E. R. Ambrose, air conditioning engineer of the American Gas and Electric Service Corporation of New York, from a report prepared by Mr. Ambrose and Philip Sporn, president of the corporation. Mr. Ambrose said the system, a 225 horsepower installation using outdoor air as the heat source and heat sink, operates at a coefficient of performance of from 4.28 to 2.85, depending on the speed of the fans and the number of compressors operating.

The Appalachian Electric Power building encloses a volume of 1.15 million cubic feet, excluding the garage; is 152 feet long by 96 feet wide by 60 feet high and provides 87,600 square feet of floor area. The outdoor air coils are located in the penthouse above the sixth floor and the outdoor air fans are located directly above on the penthouse roof.

The fans discharge the outdoor air vertically downward through the coils, then back to the outside. Basement storage tanks charged with warm or cold water, depending on the season, provide practical compressor selections having flexible and efficient operation. All of the other heat pump equipment is located in the penthouse above the sixth floor.

Individual room control is obtained by 153 unit room air conditioners located throughout the building, and supplemented by a direct system for ventilation air. The system consists of three heat pump units of 75 horsepower each.

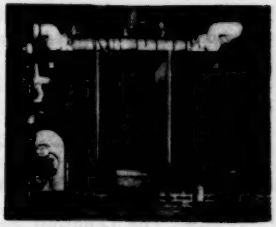
PRODUCT APPLICATIONS

New, Unusual, or Ingenious Uses of Equipment and Materials

Controlled Temperatures Cut Potato Spoilage

PROBLEM: When the Utz Potato Chip Company planned a larger new plant in Hanover, Pa., a major problem was to provide correct temperature in potato storage rooms to prevent spoilage. A potato chip producer ordinarily buys a year's supply of potatoes in the fall and stores them for use through the year. Rotting and sprouting may cause serious financial loss but can be controlled by storage at ideal holding temperature.

SOLUTION: Heating contractor H. N. Bange of Hanover, installed a combination heating and cooling system using two No. 400 Series National Radiator cast iron boilers, each of which can carry 75% of the load. One is gas fired and the other oil fired. In addition to furnishing steam for cleaning conveyors and other equipment, the boilers maintain a constant temperature in the range between 35 and 50F in storage rooms during the winter. The storage room is equipped with finned tube convectors to avoid high velocity movement of warm air. Cooling units in storage areas maintain a similar holding temperature during the summer.

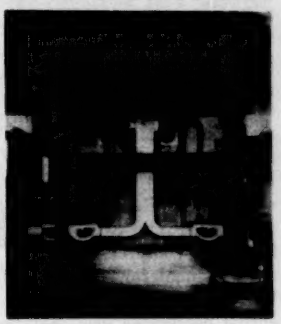


RESULTS: Sprouting and spoilage of stored potatoes is held to a minimum and employee comfort in working areas is assured throughout the year.

All-Climate Van Aids Map Service

PROBLEM: To satisfy the specialized requirements of the Corps of Engineers Mapping Units for a mobile map reproduction and handling unit, the Engineer Research and Development Laboratories, U. S. Army, awarded a contract to Anemostat Corporation of America to test and modify commercially available heaters for use in van-type bodies mounted on standard military truck chassis. The trucks were to operate in sub-arctic temperatures.

SOLUTION: Major components of the heating and air cooling systems are mounted on aluminum shells constructed over the welded steel cab of the truck and a ventilating system is located within the van. The heating system utilizes an S-200 Series Janitrol gasoline burning aircraft heater and the air cooling components are encased within the same housing except for a control box mounted within the van body. An axial flow blower is driven by a ¼ hp, 24 volt dc motor and serves the duct system mounted in the wall. Ducts are fitted with Anemostat diffusers mounted on the ceiling and along the lower front panel of the van. Both heating and cooling systems are thermostatically controlled. Two fuel systems are provided for the heating cycle, both drawing gasoline from the truck tank. Either system can be used independently while the other is removed for repair. Temperatures in the van are maintained well above 58, the minimum at which map reproduction is possible.



RESULTS: At outside temperatures down to —70F, the heater can be started and will heat the van interior to 65F within one hour using 100% make-up air. Recirculated air can also be used or a mixture of both. Subjected to temperatures as low as —70F in test chambers, the unit continued to operate efficiently.

Glycol is Coolant in Brewery

PROBLEM: Preliminary plans for the new $20-million Anheuser-Busch plant in Newark, N. J., contemplated use of Freon turbo systems to condense ammonia that would be circulated to the large cellars for direct expansion and for the cooling of heat exchangers that would, in turn, cool propylene glycol for attemperator rings at wort coolers. Analysis indicated that the system could be simplified and the horsepower per ton reduced by the use of an indirect method of refrigeration.

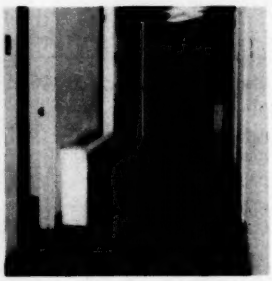
SOLUTION: The system selected employs Freon turbo and glycol brine cooling systems with glycol used as the coolant throughout the brewery. The system includes two, 710-hp, steam-turbine-driven units and one, 800-hp, synchronous-motor-driven Freon-114 unit. Twenty-eight York air conditioners are used in the brewery's three buildings. Both offices and manufacturing areas are fully air conditioned.

RESULTS: The design of the system by York engineers has been simplified and horsepower required per ton of refrigeration is reduced.

Century-Old Building Air Conditioned

PROBLEM: Many old buildings, particularly office and commercial structures, are finding it necessary to install air conditioning in order to compete with the advantages offered by newer structures. This pressure was brought to bear notably in two buildings occupying an entire block in Alton, Ill. The 100-year-old Elfgen Building with its recent addition, and the 50-year-old Alton Banking & Trust Company Building comprised the problem area.

SOLUTION: The Elfgen Building had previously been heated by hot water radiation from an oil-fired boiler sized to provide for both the existing building and a contemplated addition. Thirty-two Modu-Aire units, manufactured by U. S. Air Conditioning Corp., were installed and operated from a Bell & Gossett chiller and a 25-hp Schnacke compressor in the basement for summer cooling and connected to the hot water supply for winter heating. A 25-ton evaporative condenser was installed on the roof. Shortly thereafter the building addition went ahead and another 45 Modu-Aire units were installed, a 40-hp compressor, a second chiller, and a 40-ton evaporative condenser were added. The two systems were inter-connected so that in mild weather the 40-hp unit carries the entire load. On the heating cycle, hot water is circulated through the units and the water temperature is governed by outside thermostat. Individual room control is provided by thermostatically operated blower units. Since the building structure was such that it was possible to introduce fresh air through the units directly, stacks were installed running from the roof and introducing air under pressure into hall corridors to be picked up by the individual units. A portion of the circulated air is passed through a bank of Dorex activated carbon filters. A similar system subsequently was installed in the adjacent bank building which was built in 1901.



RESULTS: Eugene Elfgen, owner of the Elfgen Building, has found that his fuel consumption has been reduced by 1/3 since the new system is in operation. Conditions in the building are maintained at modern competitive standards in spite of the age of the building.

Constant Voltage Important to Smoke Detector

PROBLEM: A Chicago department store, after it experienced a number of fires in enclosed sections of an electric stairway system, found that adequate smoke detection immediately at the start of trouble would have prevented serious consequences. The stairway system involved hazards—carelessly tossed cigarettes, overheated motors and machinery—which could cause smoldering fires that generate insufficient heat to operate the store's standard thermal or heat activated detectors.

SOLUTION: The store management called in the C-O-Two Fire Equipment Co., for installation of a combination detector extinguisher system to protect electric stairway in the center of the store. Efficient electric smoke protection, similar to the type used for cargo protection in the holds of ocean-going vessels, depends on the use of a constant voltage transformer developed by the Sola Electric Company in Chicago. The transformer provides a uniform intensity of light source for operation of photo-electric components of the system.

RESULTS: Coupled with smoke detectors, the transformers insure immediate audible and visual warning of smoldering fires. A detector beam is maintained at desired intensity even though line voltage fluctuations may vary from 95 to 125 volts. When the alarm is sounded, its separately mounted extinguishing system with manually operated controls discharges carbon dioxide at the point of smoke generation. Low voltage applied to the lamp in the unit increases the life span of the lamp.

Window Units Built Into Walls

PROBLEM: The Langford Apartments, Winter Park, Florida, were to afford luxury accommodations at the lowest possible cost, and air conditioning individual apartments was written into the specifications. No usable space was to be occupied by equipment and the exterior of the building was to remain essentially unmarked by evidence of the system.

SOLUTION: Window type Mitchell ¾-ton room air conditioners were installed in the rear wall of the living room of each apartment in a small recessed area, which provided a decorative nook for shelves. The back of each air conditioner extends into a stairwell which is in the rear of each apartment. Units are thus concealed from the outside, and only small vents in the outside wall give evidence of the system. Units provide for cooling and dehumidification, as well as filtering dust and pollen from the air.

RESULTS: The requirements of individually controlled comfort cooling is met at low cost without obtrusion into the decorative scheme of the building.

SEND IN A PRODUCT APPLICATIONS STORY

H&V will pay on publication. Send to Editor, Heating and Ventilating, 148 Lafayette Street, New York 13, N. Y.

What Would You Do?

Replies to engineering and operating problems of interest to the industrial plant engineer

This Month's Problem

Considerable heat is carried away in winter by the air exhausted from spray-coating booths. Providing that the paint pigment is removed, is it possible to recirculate part of the exhaust air? If so, what is the limit of recirculated air permitted in order to avoid the bad effect of paint fumes on workers?

SPRAY-COATING booths are common in many industrial plants as part of a production line or service department. These booths must be properly ventilated to remove toxic material from the immediate vicinity of the booths for the protection of employees. The problem that is discussed in this issue relates to the possible recirculation of part of the air removed from the booths in order to cut down on the heating load in winter and is printed in full in the box on this page.

Perhaps you have a problem of interest to industrial plant engineers that you would like to see discussed in this department, or perhaps you have some comments that you would like to make concerning the problems scheduled for later discussion. In either case, you are invited to write the Editor, HEATING AND VENTILATING, 148 Lafayette St., New York 13, N. Y. Such letters are always welcome.

Comments Regarding the Problem

A review of many state codes, standards of the National Board of Fire Underwriters and the National Fire Protection Association, failed to find a mention of recirculation of air exhausted from spray booths or spraying operations. This would imply that recirculation of air from such an industrial operation is not to be considered or condoned. However, final decision should be obtained from the regulating authority having jurisdiction in the area where the operation is to be located.

There are two main reasons at present why recirculation is not permitted: (1) the toxicity of the materials being sprayed, and (2) the potential fire hazard of the diluents and thinners used. Lead, silica, chromates, or other toxic materials used in the pigments; or the use of benzol, toluol or other toxic solvents, preclude the recirculation of air containing these materials which have been exhausted from spraying operations. This covers dry type booths with filter units, wet type booths, or electrostatic spray-coating units.

The mal-functioning of a wet-type booth, i.e., the lack of continuous operation of spray nozzles or water walls, preclude blanket approval for such installations.

Water-wash spray booths may absorb some of the water soluble solvents, diluents or thinners. However, there may be sufficient flammable vapors present in the effluent air, which, if recirculated to a working area, may eventually build up to such proportions as to become a serious potential fire hazard. The presence of 20% by volume of the lower explosive limit of the most flammable ingredient of the mixed solvents to be found in most of the materials sprayed, would prevent their recirculation.

From an administrative standpoint it is impossible to periodically approve or disapprove recirculation due to the extreme variables encountered in the materials being sprayed as coatings.

The sense of smell cannot be relied upon to detect toxic or flammable concentrations of ingredients in a plant atmosphere which may be continuously polluted by contributions of air recirculated from spraying operations. There are no automatic indicating and control mechanisms commercially available for this type of industrial operation. If available, they would be costly.

Based on our present industrial practices, the loss of heat in air exhausted from spraying operations is a necessary item which must be included in the general over-all cost of production.

B. F. Postman
Industrial Hygiene Engineer
New York, N. Y. *Employers Mutuals of Wausau*

Recirculation of exhaust air in paint spray booths is only rarely employed. However, in a few instances, it has been successfully accomplished.

(Continued on page 130)

Problems for Coming Issues

November Issue

How do you determine what per cent of lubricating oil of one viscosity must be mixed with that of another viscosity in order to obtain an oil of desired SSU grade? Is there a formula or chart for solving such problems?

December Issue

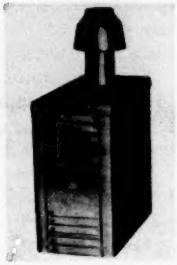
At our factory we are planning to install a large outside underground fuel tank to supply oil burners. The location favored for the tank is one where some ground water may be present. Is it best to abandon the proposed location or are there some installation safeguards to follow?

NEWS OF EQUIPMENT AND MATERIALS

Use the prepaid postcard opposite Page 114 for securing additional information on items described in this department.

Boiler for Gas-Restricted Areas

A new gas-to-gas model Hydrotherm heating boiler, which automatically switches its source of heat from the city gas line to a stored reserve of bottled LP gas, is announced by Hook & Ackerman, Inc., New York, N. Y. The switch is made by an outside thermostat, installed in addition to the regular room thermostat, which transfers the source of heat from utility gas to the bottled reserve. The LP reserve can be renewed at any time.



The unit has the advantage of making gas available to those who would like to use gas heat but might be denied it by the gas company which is unable to add additional heating load in severe weather. Another advantage is that it can be used now in those sections that are not yet opened to utility gas because steel is not available for pipe lines.

The boiler will burn both natural or LP gas at maximum efficiency. All controls are enclosed in the boiler jacket. The gas inlet for natural gas supply is at the rear of the boiler. The LP gas inlet terminates inside the boiler jacket and can be extended in the field with copper tubing to suit local conditions. The outside thermostat switches from natural gas to LP if the outside temperature drops below a minimum temperature predetermined by the utility. Thermostat can be procured locally to comply with regulations of the utility. This outside temperature control requires a single pole double throw snap action contact arrangement; in one position it establishes the connection from the room thermostat to the natural gas valve and in the other position it establishes the connection from the room thermostat to the LP gas valve.

For more information, circle on Inquiry Card, **Item 1**

Two Water Heater Controls

Two controls designed for the water heater market are announced by Appliance Controls Division, Minneapolis-Honeywell Regulator Co., Los Angeles, Calif.

The water heater control, Model Q5111A, illustrated, provides an inexpensive combined thermostat and gas control valve that will convert a side arm heater and water tank into an automatic domestic hot water system. A pilot shut-off cock, pilot tubing, and a pilot tip are included in the packaged set. This item is being marketed primarily through wholesalers and heating dealers. It can be installed as conversion equipment on existing manually operated side arm water heaters, or can be sold along with new heater installations. It lists at $10.

The Watertender, Model V5119, is being marketed as original control equipment for automatic water heaters. This unit consists of a snap-action thermostat, a pilot-light adjustment, and a thermomagnetic pilot with a safe-lighting feature.

For more information, circle on Inquiry Card, **Item 2**

Adjustable Position Circulator

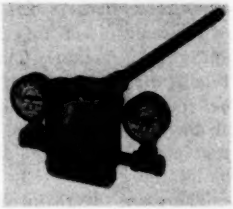
A hot water circulator, which can be swiveled to any position of flow by loosening only one clamp, is available from Econo Products Co., New York, N. Y. This adjustability can be attained without removing bolts or gaskets and is done by loosening the Allen screw clamp and turning the pump assembly.

Circulator has a 3-bolt flange, heavy bronze Oilite bearing, Neoprene oil seal and rotary water seal. The shaft is of stainless steel and the impeller is of the open fin type which prevents overheating under heavy head pressure. It is furnished with the company's vibration dampeners which are said to reduce noise transmission. It is available in four sizes, ¾, 1, 1¼ and 1½ inches.

For more information, circle on Inquiry Card, **Item 3**

Regulator Controls Dampers

The Accritem, an expansion stem type regulator used to maintain liquids or air at any temperature desired by controlling pneumatic or water operated diaphragm valves or dampers, is available from The Powers Regulator Co., Skokie, Ill. It is intended for instantaneous water heaters, heat exchangers, water storage heaters, vats, dryers, and dry bulb and dew point control.



Simple rugged construction withstands vibration and insures many years of reliable service. Has adjustable sensitivity and overheat protection. Calibrated dial temperature adjustment. Temperature ranges 50 to 250F and 150 to 350F. Easy to install at point where temperature is to be controlled. The device requires compressed air or water at 15 lb pressure. Small size regulator head is 2⅞ x 3⅝ inches, sensitive bulb is 12 inches long with ½ inch IPS connection.

For more information, circle on Inquiry Card, **Item 4**

BUSINESS IN MOTION

To our Colleagues in American Business . . .

The fact that a Revere Distributor is now celebrating its 125th anniversary year is an indication of the service the company has given its customers through those years. It is also another proof of the essential function performed by distributors for American industry. Most goods, whether industrial materials such as copper and copper alloys, aluminum alloys, iron and steel, or consumer articles such as refrigerators, radio and television receivers, kitchen utensils and ranges, go through the hands of distributors. Generally speaking, only the large buyers are in a position to purchase direct from manufacturers, who do not find it economical to handle the smaller orders. Yet those orders when pooled in the hands of an organization set up to handle them attain sizable totals, and hence a good distributor account is exceedingly attractive to a large manufacturer such as Revere.

A distributor serves not only the factories from which he buys. He also performs an invaluable service to his customers by making quickly available to them the products they require. A machine shop, for example, may need only a few hundred pounds of brass rod; there is a distributor within easy reach who can furnish it almost immediately. Or a contractor may want a few pieces of steel pipe and a thousand feet or so of copper water tube. Again, the distributor has them. A metal products distributor has to carry such items and an infinite number of others. The Revere Distributor who started in business 125 years ago actually has in stock 53,000 different items, cataloged, indexed, and held in warehouses ready for immediate shipment throughout its territory. Each month this stock is drawn upon by 5,000 to 8,000 customers, each order relatively small. There are many Revere Distributors with similar stocks and offering equal service.

To keep this distributor's warehouses filled with a balanced inventory, 18 people are required in his purchasing staff, which includes specialists in various kinds of materials, machines, tools and supplies. And to serve customers with information, quotations and the like, 25 salesmen are on the go constantly, calling on manufacturers, contractors, builders and stores throughout the busy industrial area in which the distributor operates. The large business done by the company is in great contrast to that of 125 years ago, when it was little more than a hardware store. The enterprise has grown in the American tradition of freedom to prosper in accordance with the principles of reliability and efficiency, fair dealing and integrity in performing a desired function.

Revere Distributors are selected for their ability to serve, and also chosen as to location, so that no matter where you are in this big country of ours, there is a Revere Distributor within easy reach. Today metal stocks may be short due to defense demands but manufacturers are doing everything possible to keep distributors supplied.

If you buy from distributors we suggest you remember that they are not only "central stockrooms," but have a great deal of special knowledge about the products they sell and can give you much helpful advice. Not only that, through the Revere Distributors you can be put in touch with the Revere Technical Advisory Service, which will cooperate with you on matters concerning the selection and fabrication of the Revere Metals. Our distributors, and those of every other manufacturer, render many essential services, both to those to whom they sell, and to those from whom they buy. The distributor system as it operates in the United States arose in response to the need for it. Today it fulfills that need more effectively than ever before.

REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

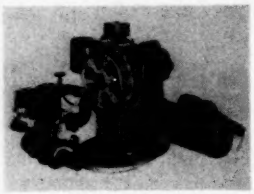
Executive Offices:

230 Park Avenue, New York 17, N. Y.

SEE "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY

Industrial Oil-Gas Burners

A line of five Hev-E combination oil and gas burners has been introduced for industrial applications by Cleaver-Brooks Co., Milwaukee, Wis.



Advantages of the new line of burners include a forced air draft system which provides a single blower fan for all air for combustion, assuring control to the fire under all atmospheric conditions. Both gas and air are accurately controlled to give high CO_2 with efficiency.

The burners can be regulated to burn the proper amount of gas or oil for the requirements of the particular installation. On all burners, low-fire start is accomplished with either gas or oil. On the two larger sizes, the AMG-5 and AMG-7, full modulation between high and low fire is available.

Electronic controls are used to guarantee that the main gas valve cannot be opened unless a pilot flame is established. These same electronic controls are those used in the burning of oil. Changeover from gas to oil on all models is quickly accomplished.

The models range from 720,000 maximum Btu per hour input in the AMG-2 size to 8,700,000 maximum Btu per hour input in the AMG-7 size.

For more information, circle on Inquiry Card, **Item 5**

Constant-Support Pipe Hanger

A new constant-support hanger, Model L, providing simplified field adjustment, increased travel range and greater load capacity with a smaller number of springs and fewer chassis sizes, is now available from Grinnell Company, Inc., Providence, R. I.

The function of a constant-support hanger, to provide equal lift in all position of travel of a piping system as it moves from expansion or contraction between its hot and cold positions, is performed more perfectly with the new Model L. A hanger structure designed for center support which places equal dimensions on each side of the center supporting line, non-resonance in its springing system and provision to give less horizontal shift of the load line as the load shifts from cold to hot positions are three new refinements incorporated in the new design. Maximum travel with constant support has been increased from its former 4 inches to 5 inches in the medium chassis and from 8 to 10 inches in the large chassis.

Engineers designing anchorages and providing clearances for the new hangers now have only three chassis sizes to be concerned with as against four, and the total load range which formerly required 28 sizes is now covered by only 16 sizes. As the load capacities and travel ranges increase from size to size there is complete overlapping of load and travel ranges so that for every load there is a Model L constant support hanger with an appropriate travel range or a choice of travel ranges.

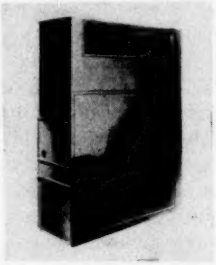
Discrepancies between calculated hanger loads and actual loads can be simply corrected in the field at the time of installation by making a simple adjustment of the position of one nut on the hanger, where previous models required three separate adjustments. This simplified field adjustment is possible because the compensating spring in the hanger requires no adjustment with a change of load setting, whereas in the former model the booster spring and the two main springs all had to be adjusted for a change in load setting.

The new model hanger provides lift that more nearly approaches the ideal of constancy, thereby further minimizing transfer of stresses in piping systems. It simplifies selection for the engineer writing specifications, and it provides for simpler correction of the differences between drafting-room calculations and actual field conditions in matching the constant-support hanger to the load.

For more information, circle on Inquiry Card, **Item 6**

School Ventilator, 3 Models

High volume heating and ventilating requirements of school auditoriums and gymnasiums are met by the Volume Ventilator, recently introduced by The Trane Co., La Crosse, Wis.



Three models for wall, ceiling and floor installations, are designed to introduce, filter, heat, and distribute up to 13,500 cfm of outside air.

A variety of mixing boxes, wall intake boxes, and outlet grilles, all optional equipment, make the unit adaptable to any installation. Nonfreeze steam heating coils are standard.

For more information, circle on Inquiry Card, **Item 7**

Method of Cleaning Oil Tanks

A positive method of removing accumulated dirt, water and sludge in indoor and underground fuel oil storage tanks without removing the oil or shutting off the burner, is announced by National Tank Cleaning Co., Baltimore, Md.

Known as the Visa-Clean system, this method completely removes the dirt, water and sludge instead of placing them in suspension, dispersing or attempting to dissolve them. The system and a limited number of tank cleaning machines are available on a licensed rental arrangement. The equipment may be used on any oil truck by using one compartment for the sludge oil, or it can be operated from any service truck equipped with a small tank.

For more information, circle on Inquiry Card, **Item 8**

Gimbels

great Pittsburgh store now completely air conditioned. Installation includes

1685 kno-draft

Type HPC High Pressure Air Diffusers

New Outlets Eliminate Drafts

Gimbels new weather control system includes nearly three miles of "breathing tubes" -- the metal ductwork for carrying air.

Most of this ductwork is for distributing the conditioned air throughout the area the new system serves. But some of it is for "return" air from each floor, going back to the filters and spray cooler.

The Carrier Corp. installed all this ductwork. An outstanding feature is that most distribution ducts are small in size—only 14 inches wide and eight inches high—installed unobtrusively on the ceiling.

GREATER VOLUME

The explanation is that this is a high pressure system, and that the smaller ducts carry a much greater volume of air.

From the supply fan, the air is forced down a central shaft, formerly a freight elevator shaft. From this central shaft, twin feeder ducts branch off down both sides of each floor. And these twin feeder ducts are connected at regular intervals by the distribution ducts, forming a huge grid pattern.

The air diffusers, or outlets, are installed at regular intervals along all the distribution ducts. Gimbels new system includes 1,685 of these specially-designed outlets, which are made by the W. B. Connor Engineering Corp., New York.

These outlets can be individually adjusted. They release the cool air in a virtual jet, in a horizontal fan pattern well above the heads of clerks and customers.

But there is no draft, although the air jet does create a gentle stirring which maintains a "live" fresh atmosphere throughout the whole area.

● Kno-Draft Type HPC High Pressure Air Diffusers operate at high pressure and velocity yet provide *draftless* distribution of air to large open areas. Reason — a new type perforated damper, combined with an interior baffle and jet exit.

Kno-Draft Type HPC High Pressure Air Diffusers are space savers, too — requiring only small, uniform, exposed ducts. They are completely adjustable to any volume between 90 and 180 cfm, or may be shut off. Operating velocities up to 3,000 fpm with 2" static pressure in ducts. Air induction high, with primary air 25° colder than room air.

For complete information on Kno-Draft Type HPC High Pressure Air Diffusers and their application possibilities for you, mail the coupon today.

TRADE MARK "KNO-DRAFT" REG. U. S. PAT. OFF.

W. B. CONNOR ENGINEERING CORP

Danbury, Connecticut

Air Difrusion • Air Purification • Air Recovery

In Canada: Douglas Engineering Co., Ltd., 190 Murray Street, Montreal 3, P. Q.

W. B. CONNOR ENGINEERING CORP.
Dept. J-101, Danbury, Connecticut

Please send me, without obligation, Bulletin K-26, which provides full information on the NEW TYPE HPC Kno-Draft Air Diffuser.

Name .....

Position .....

Company .....

Street .....

City ..... **Zone** ..... **State** .....

Industrial Process Controller

A new instrument that provides sensitive, instantaneous and accurate control of flow, temperature, pressure, liquid level and other industrial process variables has been developed by Minneapolis - Honeywell Regulator Co., Philadelphia, Pa.

The device, the Tel-O-Set controller, is the latest component in a series of new devices designed to improve process control. The other components of the group are the differential converter, Tel-O-Set indicator and Tel-O-Set recorder.

The controller was developed for use with the other three components. It is further described as a low-cost, easily installed, compact unit which provides maximum trouble-free operation. In addition to its extreme sensitivity and rapid response to process change, the controller operates on a pneumatic balance principle which eliminates friction and lost motion.

The new model is made in two types, one with fixed proportional band, the other with adjustable proportional band (illustrated). The units are constructed of a number of coded, interchangeable sections separated by diaphragms. Except for manual adjustments of reset on the band unit, the controllers operate wholly in response to pneumatic signals.

For more information, circle on Inquiry Card, **Item 9**

Packaged Water Treatment

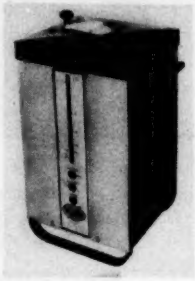
A new all-organic water treatment formula for domestic and commercial heating boilers is announced by Water Treatment Company of America, Pittsburgh, Pa., which has been prominent in organic boiler water treatment and research for years but which has never before entered into mass distribution outside industry.

First applications are being received from plumbing and heating supply distributors for multi-county franchises to handle the new heating boiler formula. The major part of the formula's national distribution will be conducted through the warehouse chain of American Radiator-Standard Sanitary Corporation, but selected territories are still being franchised to properly located distributors or jobbers whose coverage does not conflict. Some of these franchises may carry an option to bottle locally under private label. The new product, which will be retailed under the Baerite brand, is the first packaged product the company has ever offered. The formula is described as a fluid consisting of organic concentrates which have the ability to cleanse an entire heating system of collected scale and rust and also to inhibit further formations. Since scale and rust coating in a boiler or heating system form an insulation which resists heat transfer, use of the product is said to increase efficiency of older boilers by 30% to 50%, depending upon the original condition. The company issues an unconditional guarantee on the product against harmful effects of the formula to any metal, gaskets, etc.

For more information, circle on Inquiry Card, **Item 10**

200 Amp. Transformer Welder

A new 200 ampere transformer welder is announced by Air Reduction Sales Co., Div. of Air Reduction Co., Inc., New York, N. Y. This Model MCM welder is designed for general maintenance and production welding. It is a rugged unit with easy-to-operate controls and is built for long, dependable service in shop work and industrial plants. Four variations are available—220 volt or a 220/440/550 volt unit, each with or without power factor correction.



Two open circuit voltages are provided, 80 volts on the low range and 55 volts on the high range. This combines easy arc starting with a lower KVA demand load and primary ampere current.

Safe, dependable operation is assured by complete, up-to-the-minute insulation throughout. The easy-to-read current indicator affords quick adjustment of welding current. Maintenance costs are low because there are no moving parts, and each part is designed for long life even under tough operating conditions.

For more information, circle on Inquiry Card, **Item 11**

Commercial Gas Incinerator

An automatic, heavy-duty gas-fired incinerator, designed to handle the disposal of wet or dry garbage and combustible refuse in stores, institutions, clinics, small apartment houses and multiple dwellings, is available from Incineration Division, Bowser, Inc., Cairo, Ill. The unit has a 4-bushel capacity and is known as the Incinor Model S-224. It is approved by the AGA for use with natural, manufactured and mixed gases.

The burner unit employs a broad ribbon type flame and has an input of 40,000 Btu per hour. The high input is designed to provide fast, complete combustion. A thermocouple shut-off control serves as a protection against both gas and flame failure.

An insulated charging door is located waist-high in the cast iron top. Grates are heavy cast iron. The drawer-type ash receiver is conveniently located in the base. Firing chamber is of welded steel. Outer casing is attractively finished in baked silicone base aluminum enamel.

For more information, circle on Inquiry Card, **Item 12**

From Sprawling Plants to Towering Factories

Trane Serves Defense Industry Everywhere

In defense plants everywhere . . . from sprawling aircraft plants in California to towering factories in Brooklyn . . . from shipyards in New Orleans to an instrument factory in Minneapolis . . . from giant atomic projects to smallest shop – Trane heating equipment serves everywhere.

And it serves plants of every type, too! For example . . .

Assembly Lines – In Detroit at a tank plant, where the huge General Pershings are assembled between walls hundreds of feet apart, Trane Torridors throw blankets of heat over wide assembly areas.

Paint Shops – A west coast plane factory created a partial vacuum and plenty of cold drafts when they exhausted fumes from their paint shop. They used Trane Heating Coils in outside walls to heat the air used to correct negative pressure and kill the drafts.

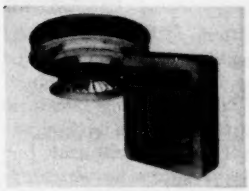
Gauge Rooms – A precision bearing manufacturer in Indiana wanted to protect his master gauges against expansion and contraction caused by temperature changes. Trane Climate Changers teamed with a Trane Compressor were installed in the gauge room – maintain constant temperature to within one degree.

Stock Stations – In a New York radar factory, a forest of parts-storage bins blocked air circulation and prevented even heating. A Trane Projection Unit Heater, mounted above each storage area, solved the problem economically by pouring heat down over the shelf sections and spread heat to every corner.

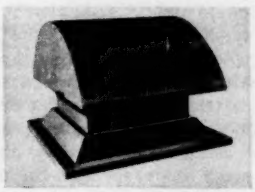
Shipping Areas – The busy shipping doors of a northern munition plant let in blasts of sub-zero air every time they opened. To stop the cold air, Trane Horizontal Unit Heaters hang a curtain of heat over each door opening.

And in tool rooms, drafting rooms, offices, cafeterias, rest rooms, lobbies–everywhere in defense plants–heating problems of all types are solved effectively with matched Trane Products.

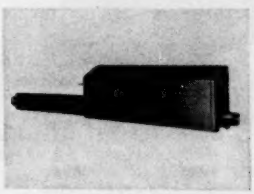
Whatever your heating, ventilating, cooling or air conditioning problem, whether defense plant, military base, school, hospital or housing, look for the answer in the Trane line.



Both Projection and Horizontal Unit Heaters can be furnished with diffusers that can be adjusted to direct heat where desired.



This powered Trane Roof Ventilator is a complete factory ventilating system. It can circulate both outside and recirculated air.



Easy-to-install Trane Wall-Fin Heaters provide the ideal low-cost heating answer to window drafts and perimeter heating problems.

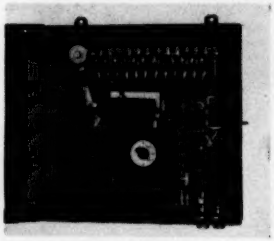
TRANE

MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division . . . Scranton, Pa.
Trane Company of Canada, Ltd., Toronto
Offices in 80 U. S. and 14 Canadian Cities

Compressor Step Controller

A pneumatic Step Controller has been developed by Johnson Service Co., Milwaukee, Wis. It may be applied to many sequence control problems, but is designed especially for controlling multiple stages of refrigeration capacity. Capacity control is accomplished by starting and stopping compressors in sequence, loading and unloading cylinders, or a combination of both.



The unit is available in 4, 6, 8 or 12-switch models. Each of the single-pole, double-throw switches is operated by a pair of cams on a shaft which is rotated by a pneumatic piston in response to a pneumatic temperature or pressure measuring instrument. The *on* and *off* points of each switch are individually adjustable over the entire range of operation. Several different springs are available for the piston, to provide a selection of ranges, or the piston may be provided with a pilot positioner to permit adjustment of the operating range.

The controller is provided with a current failure solenoid which exhausts air from the piston, returning all switches to their normal position whenever current is interrupted. An adjustable time delay, providing up to 12 minutes for a complete piston stroke, assures sequence starting, regardless of the demands of the controller, when power is restored.

The unit is mounted on a sub-panel which is inserted into a metal cabinet. All internal electric wiring and air connections are provided as part of the assembly. The controller is ordinarily operated by a thermostat located in the chilled water line, or by a pressure controller actuated by the suction pressure.

For more information, circle on Inquiry Card, **Item 13**

Zone Air Conditioning Units

A line of control system zoning Weathermakers, designed to provide independent control of air conditioning in separate areas of a building through a single unit, is announced by Carrier Corp., Syracuse, N. Y. Five sizes are being produced with air conditioning capacities ranging from 12 to 58 tons. The number of zones possible with the factory-built damper section varies from five for the smallest size to 14 for the largest. Intermediate sizes include 7 and 10 zone units.

The units will be particularly useful in office or other multi-room buildings, manufacturing plants, and other spaces where cooling or heating loads vary in different rooms or areas due to the changing position of the sun. In manufacturing plants, start-up or shutdown of heat producing power equipment in various parts of the plant makes zoning equipment especially applicable.

The new Weathermakers are of the horizontal blow-through type. Damper control for separate zones is provided through a double outlet arrangement, with one outlet supplying cooled and dehumidified air and the other supplying warm air. These twin outlets are divided into separate dampering compartments.

An independently operated double damper in each twin compartment regulates the proportion of warm and cool air for the zone, shutting down on the supply of one as the other is increased.

For more information, circle on Inquiry Card, **Item 14**

Stops Oil Screen Clogging

A new fuel oil additive, which virtually eliminates filter screen clogging in domestic fuel oil burners, is being marketed by Shell Chemical Corp., New York, N. Y. The new product is called Ionad 17.

For years domestic fuel oil has been plagued with sludge and tarry deposits. Such residues foul filter screens and burner parts, causing frequent shutdowns for emergency service. Research on the problem uncovered the cause and led to the development of the additive. Field tests have proved the additive to be stable, non-corrosive and easy to use. Along with its non-clogging feature, it reduces the severity of treatment usually required by the refiner.

For more information, circle on Inquiry Card, **Item 15**

Water Filter for Air Lines

A compressed air line filter which functions also as a condenser, due to its extra size and extended surface, is announced by Air-Line Engineering Co., Cleveland, Ohio.

Called the Airlenco condensing filter, this device has a steel outer shell 6 inches in diameter and 36 inches long and a steel inner cartridge 5 inches in diameter by 24 inches long, loosely packed with Fiberglas. A cast aluminum head with inlet and outlet openings is bolted to a flange welded to the outer shell. Air enters the inlet opening and passes down between the inner and outer shells. Expansion of the air and the extensive cooling surface that is provided by the design cause any moisture that is in the air to condense and fall to the bottom of the outer shell, where it is discharged through the drain valve. The air then passes through the Fiberglas in the inner cartridge, which baffles out any remaining moisture without appreciably reducing the pressure in the line.

Being non-absorbent, the Fiberglas will last for many years, so that the filter requires no servicing except frequent draining to get rid of the accumulated water and oil.

For more information, circle on Inquiry Card, **Item 16**

MULTI-VENT

T. M. Reg. U. S. Pat. Off.

Low Velocity Air Diffusion
CEILING PANELS

in Pittsburgh's

...FEWAY CENTER BUILDINGS

Multi-Vent panels have been specified throughout for diffusing both cooled and heated air in all the interior bays of the first three office buildings, now under construction.

Mayer, Sharp & ...

Selected for . . .

TRULY DRAFTLESS, NOISELESS AIR CONDITIONED COMFORT . . .
for over 8000 office workers, summer and winter.

Plus these great advantages possible only with Multi-Vent...

COMPLETE FREEDOM IN LOCATING MOVABLE PARTITIONS
Partitions may even bisect a diffusing panel without disturbing in any way Multi-Vent's incomparable over-all uniformity of room air movement, temperature, and humidity.

COMPLETE FREEDOM IN LOCATION OF LIGHTING FIXTURES . . .
for Multi-Vent panels are completely concealed in standard acoustical ceilings, and in no way interfere with interior design.

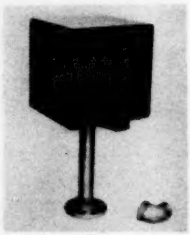
RADIANT PANEL HEATING AND COOLING EFFECT ADDS TO THE COMFORT FACTOR
The large areas of the ceiling which function as distribution plates for the Multi-Vent panels are heated or cooled to the temperature of the supply air.

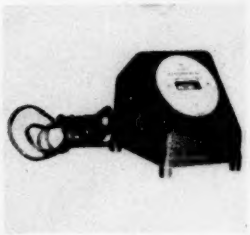
See SWEET's Arch. & Eng. files or write for detailed literature.

MULTI-VENT DIVISION **THE PYLE-NATIONAL COMPANY**
1374 North Kostner Avenue Chicago 51, Illinois

Fuel Oil Delivery System

The Bressler Fuel Requirement Anticipator, designed for planning fuel oil delivery systems, has been announced by Bressler Engineering Service, Oregon, Ill. The instrument is tied in with a card index system so that the fuel oil dealer can anticipate when each of his customers will require oil delivery.



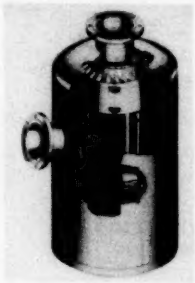


The system consists of an outdoor heated box called the heat measuring unit (left illustration) which is connected with the heat recorder unit inside (right). The loss of electrically supplied heat from the outdoor unit is in accordance with the severity of the outdoor temperature and gives a reading on the heat measuring unit. On the card index is noted the K factor or unit fuel consumption required in each job and the meter reading at the time of the last fuel delivery. By simple arithmetic, knowing the number of points on the heat meter which have elapsed since the last delivery and the amount of the last delivery, the time of the next delivery can be determined with a minimum of effort. The system lists at $112.75. Complete instructions and wiring information is supplied for each instrument.

For more information, circle on Inquiry Card, **Item 17**

Purifier for Steam, Air Lines

A receiver-type purifier has been developed by V. D. Anderson Co., Cleveland, Ohio, for removing destructive entrainment from vapor lines. Applications for this unit include: (1) installations to protect turbines and steam engines by removing damaging slugs of entrainment; (2) use in exhaust steam installations where it is necessary to remove oil and other undesirable entrainment; and (3) removing condensate from compressed air systems.



Chief advantages include low initial cost, no moving parts, a self-cleaning action which eliminates maintenance, and careful fluid dynamics designing which provides for handling extreme velocities at high efficiency and reduces pressure drop to a minimum.

Specific guarantees for individual applications are made. In steam installations the unit is guaranteed to deliver 99.9% quality steam, i.e.. to purify steam from a boiler having a concentration of 1,000 ppm solids to less than 0.5 ppm solids. In exhaust steam, the unit is guaranteed to remove 99% of the oil or to deliver exhaust steam containing less than 2.5 ppm oil.

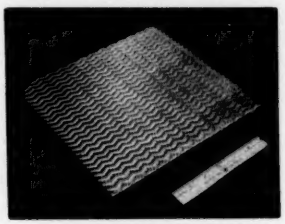
Flow of vapor through the purifier is as follows: Entrainment laden vapor enters the receiver at the inlet and drops suddenly in velocity, causing most of the entrainment to drop to the bottom of the drain. The vapor then passes into an Anderson multistage purifier on the inside of the drum which removes virtually all remaining entrainment, discharged by ejects. After leaving the bottom of this purifier, the clean steam passes through the receiver outlet.

Units are made in nominal size from 4 to 16 inches. Complete information is contained in Bulletin 300.

For more information, circle on Inquiry Card, **Item 18**

Compact Heat Transfer Surface

Successful fabrication and operation of large brazed aluminum heat exchangers, contributing to new efficiency levels in chemical, petroleum, oxygen and other process industries, have been revealed by The Trane Company, La Crosse, Wis. The new brazed aluminum heat exchangers, an outgrowth of a development by the company for military aviation in World War II, are said to perform their heat transfer tasks in one-quarter the space, with one-third the weight, and at approximately half the cost of comparable conventional units.



Some of the units pack up to 450 square feet of heat transfer surface into a cubic foot of space, nine times the surface in a conventional shell-and-tube exchanger with ¾-inch tubes.

The new heat exchangers have a variety of potential uses in chemical and petroleum processes and the transportation and air conditioning industries.

Basic design of the heat exchangers is relatively simple. The units are built up of alternate layers of corrugated fins and flat sheets of aluminum. The units can be designed to transfer heat from gas to gas, liquid to liquid, or liquid to gas.

Unlike conventional heat exchangers that are limited to two streams, the new units may be built with as many as five different streams of gas or liquid. These streams may flow across each other, parallel to each other or in opposite directions. Streams may be taken off at any point along the length of the new heat exchanger, a feature not readily available with existing equipment. The fundamental flexibility of the core construction permits engineers to work out almost any conceivable combination of circuits, temperature drop and pressure drop for particular processes. The illustration shows only one of many types.

For more information, circle on Inquiry Card, **Item 19**

PRODUCT INFORMATION SERVICE

Use the postage-free postcard below for further information on:

- **News of Equipment and Materials**
- **New Catalogs**

Circle the Item Numbers in which you are interested and print clearly your name and address with title.

NEW CATALOGS

BLOWER TYPE UNIT HEATERS

A 16-page bulletin, No. 2301, describes in detail the answer to heating problems in large areas like factories, warehouses, railroad stations, auditoriums, and garages. The bulletin, published by C. A. Dunham Co., Chicago, Ill., is devoted to its blower type unit heaters and accessories, such as mixing dampers, by-pass dampers, filter sections, and duct connections. .....Item 20

POWER PLANT EQUIPMENT

A 12-page bulletin, S-196-C, describing in condensed form its line of power plant equipment, is available from The Swartwout Company, Cleveland, Ohio. It is profusely illustrated with photographs, flow diagrams, dimensional drawings, performance charts and specification tables. It describes control valves, pressure master controls, desuperheaters, temperature master controls, water regulating valves, liquid level and drainage controls, differential pressure controls, feed water heaters, feed water regulators, separators, exhaust heads, air separators, and other accessories. .....Item 21

CONVECTOR CATALOG

Catalog 702A, entitled Airtherm Convectors, has been issued by Airtherm Mfg. Co., St. Louis, Mo., of 16 pages, the bulletin gives comprehensive descriptive, dimensional, and capacity data, together with piping details and typical convector specifications. .....Item 22

COPPER FITTINGS AND VALVES

A 104-page Catalog G, covering its line of Nibco copper fittings and bronze valves, has been issued by Northern Indiana Brass Co., Elkhart, Ind. Sizes, prices, weight and dimensional information is given on the full line as well as engineering data on the use of copper tube fittings and valves. .....Item 23

HOT WATER RELIEF VALVES

A 4-page folder has been published by Watts Regulator Co., Lawrence, Mass. to assist the user in purchasing the correct type of relief valves for domestic hot water tanks and hot water space heating boilers. The necessity for relief in both types of installation is thoroughly explained and illustrated. .....Item 24

PIPE AND FITTING INSULATION

Insulating products, including 85% magnesia, are described in an 8-page bulletin, No. 4h, by Ehert Magnesia Mfg. Co., Valley Forge, Pa. Bulletin presents characteristics and advantages of Thermalite 85% magnesia insulation for covering pipe, fittings and equipment. Tables include recommended insulation thicknesses for various temperature ranges. Copy summarizes recommended application procedure. Other insulations briefly described include: Enduro for high temperatures, insulating and finishing cements, asbestos sponge felt, air cell, wool felt, anti-sweat, frostproof, heat-seal blankets, hair felt, Fibrekote, asbestos paper, wick and rope. .....Item 25

WATER HAMMER IN PIPING

Cause, effect and control of water hammer in piping systems are considered in an 8-page bulletin, No. WH-851, published by The Williams Gauge Co., Pittsburgh, Pa. After describing water hammer in non-technical terms, the brochure indicates its potential damage to piping, instruments and other parts of water systems, and then considers methods of controlling it.

A phase of hydraulics about which little is known, water hammer was studied in detail in several hundred tests. Among other things, the intensity, the action of the pressure wave and the origin of water hammer were studied. Shown in this new brochure are a number of curves representative of some of these tests. The curves indicate pressures up to 304 lb developed in 1/10 of a second, and illustrate the bellows-like expansion and contraction of a pipe subjected to water hammer. .....Item 26

EXPANSION JOINTS FOR PIPING

A new catalog, No. 51, containing over 78,000 possible combinations of bellows type expansion joints, has been published by Solar Aircraft Co., San Diego, Calif. This 40-page catalog serves as a reference handbook and it illustrates a diversified line of standard and special bellows assemblies used to take up expansion, contraction and offset movements in pipes and conduits. Several unique designs developed by the company are described in this catalog, as well as many unusual types of bellows applications for the purpose of absorbing motions resulting from pressure or temperature changes in the conducted gases and liquids. These bellows assemblies are manufactured under the trade name of Sola-Flex and range in sizes from ½ inch to 72 inch pipe sizes covering a complete line of pressures from vacuum to 1,000 lb. The bellows are fabricated from stainless steel and a variety of heat and corrosion-resisting alloys. .....Item 27

STEAM COST CALCULATOR

A new and modernized slide rule calculator for computing steam costs is available from Cleaver-Brooks Co., Milwaukee, Wis. The calculator, in handy pocket size, is available without cost to engineers, plant executives, and those who will find it useful in their work. It enables the user to compute the comparative steam costs per 1,000 lb using coal, oil, or gas based on fuel costs of price per ton, price per gallon, and price per cubic foot. .....Item 28

PRIMER FOR RUSTED SURFACES

A 4-page folder, Worried About Rust, tells how Ospho, a metal primer applied directly over rusted surfaces, stops rust and primes metal for paint. Advantages, prices, containers and other interesting information are all covered in this easy-to-read illustrated folder published by the manufacturer, Rusticide Products Co., Cleveland, Ohio. .....Item 29

PRICE SHEETS IN PLASTIC

Pocket-sized price sheets in indestructible form have been issued by McDonnell & Miller, Inc., Chicago, Ill. The sheets are embedded in crystal-clear Vinylite, one being intended for contractors and one for wholesalers. .....Item 30

Postage Will be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 38, SEC. 34.9, P. L. & R., NEW YORK, N. Y.

HEATING AND VENTILATING

148 LAFAYETTE STREET

NEW YORK 13, N. Y.

READERS' SERVICE DEPT.

OPEN STEEL FLOORING

A 16-page idea-book on Versatile Open Steel Flooring has been published by the Open Steel Flooring Institute, Inc., Pittsburgh, Pa. The book is profusely illustrated with installation photographs showing the many and varied possibilities for using steel grating. It explains types and features of open steel flooring and specifications for proper installation. **Item 31**

INDEX TO FURNACE FILTER SIZES

A catalog of Dust-Stop air filter sizes for filter-equipped warm air furnaces and blower units has been published by Owens-Corning Fiberglas Corp., Toledo, Ohio. The 50-page booklet is being made available through manufacturers of forced-air heating equipment to their distributor and dealer organizations. The publication is planned to simplify and speed the ordering of air filters. Included is an alphabetical listing of 166 manufacturers of forced-warm-air heating equipment. Listed under the name of each are the sizes and number of filters needed for units manufactured by the company and the manufacturer's identification numbers. .....**Item 32**

PROPELLER TYPE UNIT HEATERS

Contractors, architects and dealers, faced with the heating problems of industrial and commercial buildings, will find helpful ideas in a 12-page bulletin, No. 1301, on propeller fan unit heaters, released by C. A. Dunham Co., Chicago, Ill. Design and construction features of both horizontal and vertical discharge unit heaters are described, with details about heating elements, motor and fan assembly and adjustable motor bracket. Cutaway drawings illustrate the heater's construction and operation. One page tells how to place unit heaters for proper heat distribution. Capacities, conversion factors for steam and hot water, dimensions, decibel ratings, typical specifications and ordering instructions are included. .....**Item 33**

HOW TO SELECT STEAM TRAPS

Bulletin T1750, 20-pages, has been issued by Yarnall-Waring Co., Philadelphia 18, Pa., under the title Steam Trap Selector. This is an ingeniously arranged method of locating in the left-hand column the device to be trapped and from this, moving to the right, a table on trap selection for that device. The proper size of trapping is read directly from the table. Equipment used in hospitals, kitchens and laundries is grouped separately. These data are given for 160 different types of equipment ranging from acid vats to water stills. .....**Item 34**

FLY ASH COLLECTOR

To meet the demand for information on smoke control, Buell Engineering Co., New York, N. Y., has issued an 8-page bulletin entitled LR Fly Ash Collector. Designed for efficient fly ash prevention on small boiler installations of limited draft, the collector is intended for installations ranging from 75 to over 2,000 boiler horsepower, and is suitable for heating boilers in small industrial plants, apartments, commercial buildings, and institutions. Bulletin includes descriptive, capacity, dimensional and other engineering data. .....**Item 35**

PACKAGED STEAM GENERATORS

Bulletin 1D-51-115, 12 pages, has been issued by York-Shipley, Inc., York, Pa., and covering its Steam-Pak power generator. Specifications, rating and descriptive material included. .....**Item 36**

STORAGE WATER HEATERS

A 16-page, standard size catalog entitled Whitlock Type K Storage Heaters has been published by The Whitlock Mfg. Co., Hartford, Conn. These storage heaters are designed for hospitals, laundries, textile mills, apartment houses, and similar applications. Catalog gives comprehensive description of the various types of materials in which the heaters are available, dimensional data on both the horizontal and vertical type, together with data on the selection of the proper size heater, information on the use of the Type K condensate cooler, and typical hook-ups. .....**Item 37**

LARGE VOLUME WATER HEATERS

Catalog 60, 12 pages, has been issued by General Fittings Co., Providence, R. I., covering its line of instantaneous water heaters and other heat transfer units. The catalog is designed for engineers in industries and institutions who are responsible for the selection of equipment for washroom, cafeteria, dispensary and processing hot water, and also for consulting engineers, architects and plumbing contractors. The catalog illustrates typical installations and gives useful sizing data, steam consumption tables and diagrams. .....**Item 38**

STEAM GENERATORS

A Steam Generator booklet, Bulletin 1218, issued by Orr & Sembower, Inc., Reading, Pa., gives information on its Powermaster units for steam or hot water use. High or low pressure units from 15 to 500 hp are described. Details are given on special burner design and the units' ability to be changed from oil to gas firing in a few minutes. .....**Item 39**

AIR DISTRIBUTION IN TV STUDIOS

A 4-page pamphlet, Form F4712, has been issued by Barber-Colman Co., Rockford, Ill., to describe the application of its air distribution outlets to television studios which have special problems due to movable scenery, high heat loads and low noise level requirements. .....**Item 40**

POINTERS ON AIR CONDITIONING

Practical Pointers on Air Conditioning, a 16-page booklet, Form 1059, for both layman and expert, covering all phases of air treatment and air handling, has been published by United States Air Conditioning Corp., Minneapolis, Minn. The booklet describes properties of air, problems of its control, and application of diversified types of equipment to solve these problems. .....**Item 41**

STEAM HEATING SYSTEM CONTROLS

A group of five bulletins giving complete information on Webster Moderator control systems and equipment are available from Warren Webster & Co., Camden, N. J. These include: (1) electronic pressure differential control system for continuous steam flow embodying metering orifices, automatic outdoor thermostat, manual adjustments for scheduled control and automatic equipment for pressure difference control; (2) pulsating flow control embodying metering orifices, automatic outdoor thermostat and manual adjustments for scheduled control, fixed time cycle with automatic variation of on interval; (3) motor-operated throttling type main steam control valve in 1¼ to 12 inch sizes; (4) motor-operated valves for shut-off service; and (5) ten principal types of metering orifices for use in Moderator systems. .....**Item 42**

UNIT AIR CONDITIONING MANUAL

A 60-page booklet, Form AM 42-1882, entitled Application Engineering Data on G-E Personal Weather Control Systems, has been issued by the Air Conditioning Division, General Electric Co., Bloomfield, N. J. It contains comprehensive and detailed information for the application of unit air conditioning systems to multi-room buildings. It will prove helpful to architects, consulting engineers, contractors, builders and owners of office buildings, hotels, apartment houses, hospitals, and similar structures. .....**Item 43**

CENTRIFUGAL COMPRESSOR DATA

Engineers designing comfort and process air conditioning systems are given full capacity and design data for selection of centrifugal refrigeration units for the first time in a new CenTraVac bulletin, DS-399, 42 pages, published by The Trane Company, La Crosse, Wis. The new bulletin will give any engineer all information he needs to select a centrifugal unit in the medium horsepower range from 45 tons up. .....**Item 44**

POWER ROOF VENTILATOR

A 4-page folder has been issued by Iron Lung Ventilator Co., Cleveland, Ohio, describing its power type roof ventilator available in a variety of sizes and capacities and intended for heat-treat buildings, rolling mills, forge shops and pickling departments. .....**Item 45**

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
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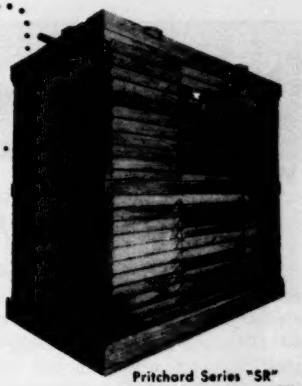

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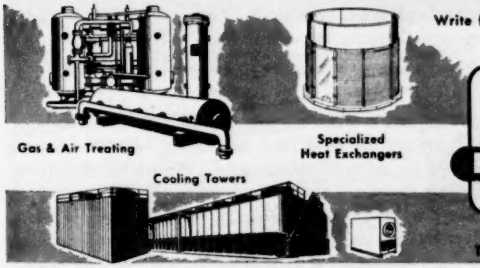
Featuring a low initial cost and greater efficiency, Pritchard Series "SR" Cooling Towers are ideal for air conditioning and refrigeration installations requiring from 3 to 35 tons capacity. Highest quality materials and better design assure longer life for these packaged units. Constructed of Redwood with steel pipe distribution system for trouble-free performance. "Slip-fit" design gives easy access to tower. Materials pre-fabricated before shipping. Investigate this low cost tower today if you're looking for higher operating efficiency in a small capacity tower.



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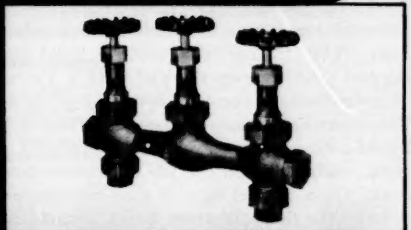

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The Honeywell By-Pass is a compact, neat, easily-installed means of by-passing control valves, traps and other pressure units. It simplifies piping arrangements by eliminating a multitude of joints, nipples and elbows . . . by using a minimum of space . . . by saving time . . . by minimizing maintenance.

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MANUALLY OPERATED PUMP for HYDROSTATIC PRESSURE TEST

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Eliminates Involved Mechanical Apparatus

INEXPENSIVE EFFICIENT EASILY OPERATED

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NEWS OF THE MONTH

WOOD FUEL

in district heating plant warms Labrador community built and supplied by air lift.

Probably the newest, fast-growing, most dramatic community in the news today lies over 300 miles from civilization and fights winter temperatures of minus 50° Fahrenheit. Burnt Creek, Canada—built to exploit the rich new iron ore discoveries in northern Quebec and western Labrador—is supplied entirely by the world's first civilian airlift.

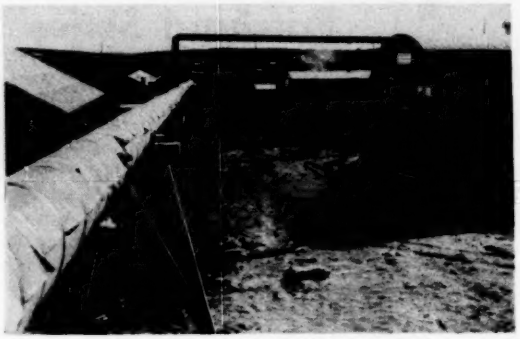
Iron Ore Company of Canada is using airlift techniques to rush the development of mines in the desolate wasteland 320 airline miles north of the St. Lawrence River port of Seven Islands, Quebec. With U. S. iron-ore reserves dwindling at a rapid rate, defense demands for this essential mineral make every hour count in getting the fabulously rich Labrador deposits out of the ground. Yet the Knob Lake-Burnt Creek region is so inaccessible that to date aircraft are the only means of getting there.

• **COMFORTS.**—Even so, the growing camp at Burnt Creek is comfortable if not elaborate. The mess hall and supply buildings are large Quonset huts—like the airlift, another heritage from the military. Bunkhouses and offices are built of logs squared on three sides, with the exterior left rough, forming walls six inches thick.

Steam heat for every building comes through insulated pipes from a central heating plant. The fuel used is firewood—a drain on the meager wood supply of this almost barren country, but a drain that will end when a dam and hydro-electric plant are built at nearby Lake Menihek.

• **POWER.**—At present, electric light and power come from an 85 kw generator powered by an International UD-24 diesel power unit.

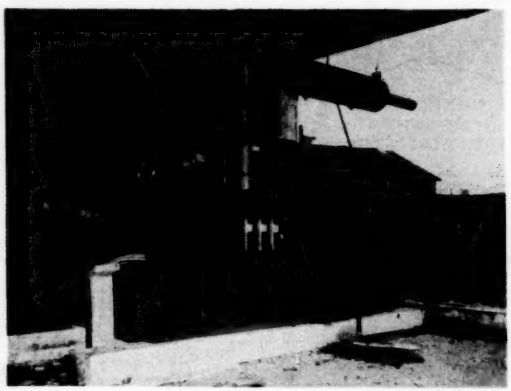
• **WATER.** — Running water for Burnt Creek comes from the creek itself—even during the arctic winter when surface ice gets four feet thick. Jacket heaters are used to protect the pumps. Plumbing facilities, including showers, are adequate for the 200 men now working at the camp. Sewage disposal is handled, wilderness fashion, by another nearby creek which flows in the opposite direction. Pipes for the water system are buried in trenches 3 feet wide and 4 feet deep, completely surrounded by sawdust for cheap, efficient insulation.



Steam heat from wood fires distributed through elevated pipelines.

• **MATERIALS.**—Except for timber and stone, all construction material for the camp, the mines, the dam, and the airstrip itself must be flown in. The first equipment—an International TD-6 tractor—was flown in piece by piece by a seaplane which landed on Knob Lake. This tractor was used to build the airstrip. Biggest plane use in the airlift is a Fairchild C-119 "Flying Boxcar" (on loan from the U. S. Air Force). This plane has already brought in fifteen International TD-14A crawler tractors shipped complete and in one piece, ready to go on the job in construction and mine work. On a typical day, 45 tons of supplies and machinery are flown in from Seven Islands for the 200 men now working at Burnt Creek, and the 600 men who will be there eventually.

A railroad—itself supplied by airlift—is being built from Seven Islands, and when operations are in full swing ten million tons of ore a year are expected to pour from the mines into the waiting ore boats on the St. Lawrence River—bound for the steel mills of Pittsburgh, Cleveland, Youngstown, and points east.

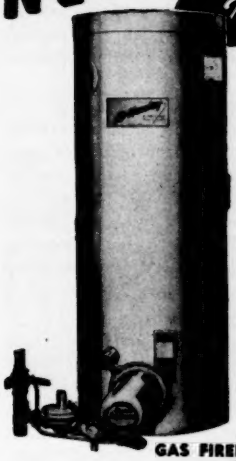


Light and power for Burnt Creek comes from a diesel-powered generator.

• Manufacturers' shipments of plumbing fixtures during the second quarter of 1951 were valued at $87.3 million, according to the Bureau of the Census, Department of Commerce. This represents an 8% decrease from the value of first quarter 1951 shipments, but a 22% increase over shipments during the second quarter of 1950.

NEW! Mt Hawley "BUDGETEER" BOILER BURNER

Ideal for Today's "Small Home" Market



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Here's a high quality, space-saving, low cost boiler especially designed to meet EVERY requirement of the ever expanding "small home" market.

Its efficient dimensional design lends itself excellently to either basement or utility room installations.

The outstanding new Mt. Hawley "Budgeteer", featuring heavy gauge, slanting tube construction, can be quickly and easily converted from oil to gas or vice versa.

It is available with domestic water coil and has a capacity of 510 ft. of hot water radiation.

Priced right, it is shipped completely insulated and jacketed for quick, easy installation.

Cash in — now — by stocking the new Mt. Hawley "Budgeteer" — the boiler especially designed for the "small home" market!

Complete details sent on request.

OIL FIRED

SIMPLE INTERCHANGEABILITY
GAS TO OIL OIL TO GAS

In the matter of minutes, the "Budgeteer" can be changed on the job from oil to gas or vice versa. This flexibility of firing equipment is a feature of interest to architects, engineers, builders and tradesmen alike, as it permits the owner to have the fuel of his choice NOW OR LATER.

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STANDARD DESIGN PRACTICES

for construction recommended by NPA to conserve materials.

In the face of the critical shortage of structural and reinforcing steel and other controlled materials used in building construction, the Defense Production Administration has adopted a program devised by its Conservation Coordinating Committee to conserve scarce materials and thus allow for more construction in 1952 with the materials available.

To accomplish this, a set of standard design practices was recommended by the Facilities and Construction Bureau of the National Production Authority, U. S. Department of Commerce, for use by architects and engineers in the construction industry.

• **STEEL.**—Sharp reductions were found necessary in allocation of structural steel for the fourth quarter. The Army, Navy and Air Force were the only groups to be allocated 100% of their stated requirements for structural steel, and even these requirements were scaled down from the estimates submitted originally. All other expansion programs, with the exception of the vital aluminum program, could be given only a part of their needs. The steel expansion program was given only 51% of its stated requirements.

Allotments for other industrial expansion were only 26% of stated requirements, while commercial, social, recreational and religious construction received only 11% of its requirements.

The fact that even projects which are directly a part of the defense mobilization program will have to wait for steel suggests that each builder or designer, before making final plans for construction, should seriously consider how quickly he wants to go ahead, DPA said.

Eventually it is expected that steel will be more freely available for other than military users. In the meantime, however, while DPA is not prohibiting the use of steel in any type of construction, it suggests that if builders want to minimize delay, they should make use of the recommended construction conservation practices.

The program is backed by Defense Mobilizer Charles E. Wilson and the 17 Government agencies connected with the mobilization program as represented on the Conservation Coordinating Committee. These agencies are expected to follow the conservation criteria in their own construction. The recommendations are incorporated in a memorandum distributed by NPA to the 17 agencies.

• **PRACTICES.**—Among the recommendations included in the memorandum are the following:

(1) Structural and reinforcing steel may be conserved in many one-, two- or even three-story buildings by using wall-bearing masonry construction in lieu of structural steel frame or reinforced concrete frame.

(2) For many types of structures, savings of approximately 50% in steel content may be made when reinforced concrete replaces structural steel, and even greater savings are possible when timber is used instead of structural steel or reinforced concrete.

(3) Many steel conservation measures are available in reinforced concrete construction, including flat slab construction instead of beam and girder, pan or masonry filler types; also the use of square or rectangular columns with ties instead of smaller columns with spirals.

(4) Fireproofing requirements are important for certain kinds of occupancy and for certain building locations, but in many instances fireproofing of adequate resistance may be obtained by specific use of non-critical materials.

(5) For many uses lightweight concrete and plaster aggregates may be successfully used to replace heavier aggregates, and thus lower quantities of structural or reinforcing steel needed for load-carrying members and foundations.

(6) Alloys for the manufacture of low alloy, high alloy and stainless steels are generally in extremely short supply. Therefore, alloy steels should not be specified in building construction where suitable substitutes are available. Enameled, plated, and even stainless clad carbon steels are conserving of alloys when used in lieu of stainless steel.

• **STANDARDS.** — NPA also identified seven design standards as good practice, considered acceptable to most engineers, architects, building officials and municipalities, and recommended their use in conserving scarce materials. These are:

For structural steel, Specification for the Design Fabrication and Erection of Structural Steel for Buildings, of the American Institute of Steel Construction; for reinforced concrete, Building Code Requirements for Reinforced Concrete, of the American Concrete Institute; for lumber, National Design Specifications for Stress-Grade Lumber and Its Fastenings, of the National Lumber Manufacturers Association.

For plumbing, National Plumbing Code, issued jointly by the NPA and the Housing and Home Finance Agency; for electrical work, the National Electrical Code of the National Board of Fire Underwriters; for design of light gage steel made of cold-formed sheet or strip less than 3/15-inch in thickness, the Light Gage Steel Design Manual; for floor or roof systems designed with open web steel joists, Standard Specifications for Open Web Steel Joist Construction of the Steel Joist Institute.

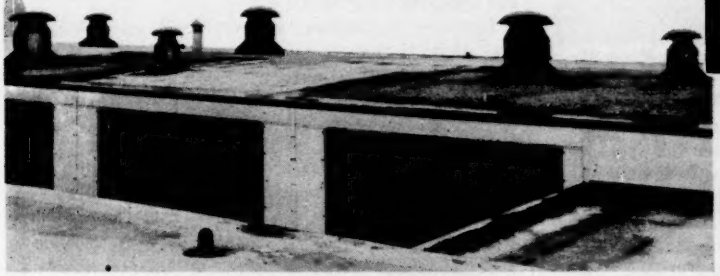
NPA stressed that the recommendations are suggestive rather than compulsory. Officials urged that they be followed, however, in view of the sharp reductions in allocations of structural steel and other critical materials.

• Alan B. Cameron has been elected president of Ruud Manufacturing Co. Mr. Cameron succeeds Richard H. Lewis, Ruud president since 1944, who had earlier indicated his desire to take a less strenuous part in the company's management. Vice president and general manager since joining Ruud in December 1947, Mr. Cameron has been connected with the gas industry for more than twenty years.

Exhaust Dangerous Fumes

THIS SAFE, EFFICIENT WAY

DeBothezat Bifurcator Roof Ventilators are ideal for exhausting abnormally hot air, corrosive, explosive or toxic fumes. Bifurcator Roof Ventilators operate with or without ducts. Compact and neat in appearance. Motors and fan wheels are readily accessible. Available with fan wheels from 12" through 48" in diameter, delivering up to 42,000 c.f.m.



6 DeBothezat Bifurcator Roof Ventilators provide both air intake and exhaust for "push-pull" system of plating tank ventilation. Photo courtesy of General Electric Company.

HOW THE BIFURCATOR FAN WORKS

The DeBothezat Bifurcator is a direct motor-driven fan with a divided housing. Gases are by-passed around the motor, which is mounted in a separate chamber—open to atmosphere but isolated from exhaust fumes. Bifurcator Roof Ventilators are equipped with weatherproof head and mounting base.

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Ric-wiL PREFABRICATED INSULATED PIPING

FURNACE BLOWER CODE

studied by manufacturers' group to provide standard for testing and rating.

A proposed code and standardized method for determining the pressure characteristics of furnace blowers is the project to which the members of the engineering committee of the Furnace Blower Manufacturers' Association are devoting their efforts. When published, the new code will provide a standardized method for furnace manufacturers to test and rate forced air furnaces.

• **BEGINNING.**—The original work on this subject was done at the University of Illinois under the sponsorship of the association. The new code will, in all probability, be based on the University of Illinois test reported in Bulletin No. 76 under the title, Proposed Arrangement and Method for Determining Pressure Characteristics of a Blower Used in a Furnace. The original report is very comprehensive, and the committee's job is to simplify and make additions based on experience and study since that time. In this work, they have the assistance of Norman Buckley, of the Timken Silent Automatic Division, who was associated with the original work at Illinois.

• **FORM.**—According to committee members, in its final form the code will follow the form prescribed by the Commodity Standards Division of the U. S. Department of Commerce in the event that the industry may wish to submit the committee's work as a Commercial Standard.

In attendance at the meeting were: Joe Brainard, Air Controls, Inc.; Norman Busch, Air Controls; Inc.; John Burrowes, Lau Blower Co.; George Gould, Viking Air Conditioning Corp.; Norman Buckley, Timken Silent Automatic Division; and Ward Brundage, The Brundage Manufacturing Co.

ASHVE ENVIRONMENT LABORATORY

in Cleveland to be inaugurated with two-day inspection, Nov. 1-2.

A two-day reception and inspection for executives, society members and the press will be held by the American Society of Heating and Ventilating Engineers in Cleveland, November 1-2, to mark the completion of its Environment Laboratory, a facility for research in human comfort conditions and the development of data for the design and installation of panel heating and cooling systems.

There will be an inspection on both days at the ASHVE Research Laboratory at 7218 Euclid Ave., where the Environment Laboratory is rapidly being brought to completion. On hand to act as hosts and explain the operation of the new research tool will be society officers, the ASHVE committee on research, the society's director of research and his staff, and members of the technical advisory committee on panel heating and cooling, under whose over-all direction the project was inaugurated.

Before inspecting the Environment Laboratory on November 1, invited executives will attend a luncheon at the Hotel Statler at 12:15 pm where they will be addressed by Cloud E. Wampler, president of the Carrier Corp. I. W. Cotton, chairman of the committee on research, will give a short briefing on the new laboratory. ASHVE President Lauren E. Seeley will preside and welcome the guests.

Members' day will be on November 2, when the general ASHVE membership will inspect the new laboratory.

• **PURPOSE.** — The Environment Laboratory, newest and perhaps most important of ASHVE facilities for fundamental research, is the society's answer to the belief that there is a lack of authentic and universal design data for panel heating and cooling installations. Early in 1947 more than 100 representative engineers from consulting firms, technical societies, government agencies, universities, trade associations and industry attended a general conference in Cleveland to discuss this situation.

It was the consensus at the meeting that the ASHVE should coordinate the program of developing, through research, adequate design data in this field. Later in 1947 a technical advisory committee on panel heating and cooling was formed by the committee on research to direct over-all technical activities for the research program. Members of the TAC were drawn from designing offices, contractors and technical institutions. As is the case with all TAC's of ASHVE, they serve without compensation.

• **PROGRAM.**—An over-all program developed by the TAC subdivided the general research problem into four spheres of activity: (1) Heat distribution within and behind the panel; (2) heat transfer between the panel and the space; (3) comfort conditions; and (4) controls.

Early in the TAC discussions it became apparent that, in order to implement these activities (heat transfer between the panel and the space), it would be necessary to construct a full sized room of dimensions comparable to those encountered in building construction wherein all the room surfaces (and portions of each surface) were separately controllable as to surface temperature so that calorimeter studies could be made under varying surface temperature conditions.

• **TWO ROOMS.** — It later became apparent that this same room could also be used for a study of radiation and comfort relationships, and to facilitate these comfort studies, it was then decided that two rooms would be necessary.

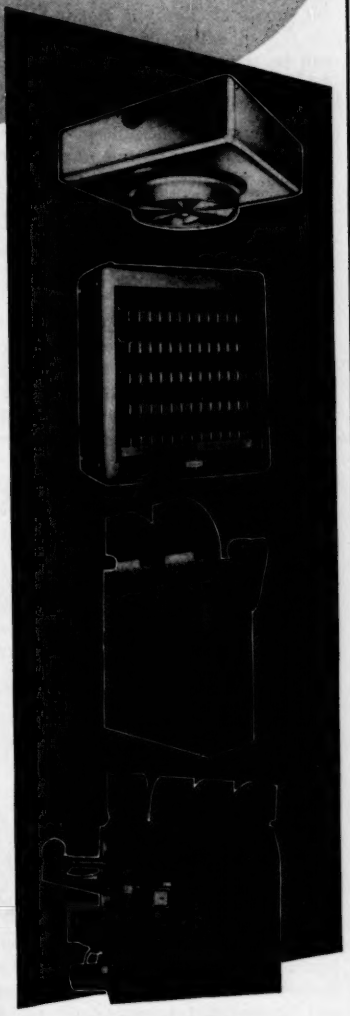
Preliminary planning began in 1948 and continued through 1949. Construction of the room was started in 1950. The room, as now constructed, occupies an interior area of about 25 feet long and 12 feet wide with an adjustable ceiling providing heights up to 12 feet. The room is designed so that it can be subdivided, when desired, into two rooms.

Funds for the research and the construction of the Environment Laboratory are being made available from industry and the general society membership.

Heating Satisfaction Through Trouble-Free Service with

AIRTHERM

A Complete Line to Meet Every Space Heating Need



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DIRECT FIRED HEATER. A complete heating and ventilating system in one compact unit. Oil or gas fired.

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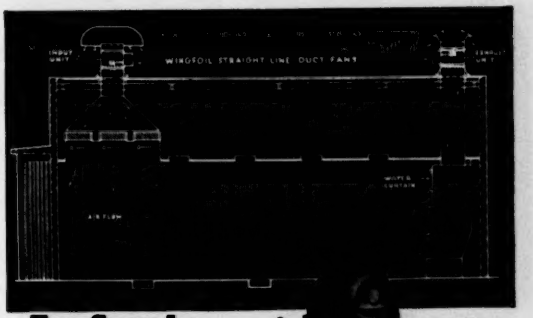

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The Wingfoil Straight-Line Duct Fan is Unexcelled

It may be used as shown above as a roof intake or exhaust, or it may be inserted in a run of duct, occupying no extra space. The motor is located outside the casing, driving the fan by means of an enclosed V-belt. It is light, compact and easily handled, and may be mounted either horizontally or vertically. *Write for Bulletin F-10.*

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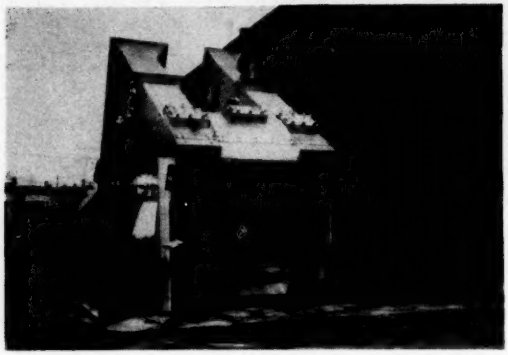
Wing STRAIGHT-LINE DUCT FANS

GIANT FAN FOR ITALY



Preliminary test of induced draft fan by research engineers of the Westinghouse Sturtevant Division, Boston, Mass. Destined for installation at Societa Edison, Centrale Di Genova power station in Italy, this fan will handle 1,240,000 pounds of 300F flue gas each day. To do this, the 5½-foot diameter wheel—driven by a 600 hp motor —will operate at 975 rpm.

PIPES FOR SOIL WARMING

similar to radiant heating coils may be used in agriculture to stimulate early crops.

Old-fashioned soil farming is anticipated as one of the next fields to benefit from forced hot water heating, according to R. E. Moore, vice president of Bell & Gossett Co., makers of hot water heating system equipment. One of the many projects being studied at B & G's Morton Grove research laboratory is the feasibility of stimulating agriculture production by warming the soil with forced hot water heat.

• **ADVANCE SEASON.**—By installing pipe coils in the earth several inches below the depth a plow would reach and circulating hot water through the coils, the earth could be so warmed as to allow the planting of crops considerably ahead of the regular planting season. In some areas, this might even allow an extra harvest or, in the case of crops such as tomatoes, the marketing time might be two weeks ahead of the regular crops.

The principle involved is similar to that employed in hot water radiant panel heating systems in homes and office and apartment buildings. The coils under the ground form a closed circuit through which the water, heated by a boiler, is forced by a booster pump.

The practice would be, in effect, "heat irrigation," the manufacturer said, and might become just as important to many farmers as irrigation with water. He added that the idea was not new, having been used in countries such as Iceland where warm water wells provided by nature furnish the heat transfer medium.

FUEL OIL SUPPLY

will be adequate, in spite of obstacles, if normal weather prevails.

The nation's fuel-oil supply picture for the coming winter is marked by obstacles, an oil executive said last month, but he expressed belief that all fuel-oil needs will be met if normal weather prevails.

In a talk prepared for the annual convention of the New York State Fuel Merchants Association, Inc., September 19, Leroy B. Fox, manager of Socony-Vacuum fuel oil sales, added a probability that all facilities will be strained to capacity to meet the forthcoming demand.

• **OBSTACLES.**—Among the obstacles which Mr. Fox cited are increased military demands and a need for meeting the world petroleum emergency created by loss of crude production and products (650,000 bbl a day) from the world's largest refinery at Abadan, Iran. He said: Today the United States is, in effect, supplying most of these emergency requirements through lower imports and increased exports.

Mr. Fox described the industry's problems in dividing the barrel of crude petroleum among gasoline and fuel oil and other petroleum products, then asserted: The oil to heat the homes of your customers next winter has been and will be produced . . . because the petroleum industry is well aware of its responsibility to you and your customers.

For many years, according to Mr. Fox, gasoline was the primary product from petroleum and the distillates, including fuel oil, were viewed as by-products. Consequently, refineries operated primarily to supply the demand for gasoline.

In the decade since 1940, however, due primarily to an increase in the number of oil burners in use and dieselization of the railroads, the domestic demand for distillates such as fuel oil has risen nearly twice as fast as for gasoline.

The result, Mr. Fox said, is that refiners now have two primary products instead of one.

In attempting to analyze future supply and demand problems with respect to distillates, the petroleum industry is confronted with two uncontrollable factors —weather and the number of oil burners installed each year. Mr. Fox said progress is being made in balancing the supply and demand of fuel oil, however.

• New officers of the Gas Appliance Manufacturers Association will take office at a special meeting of the board of directors in St. Louis, October 14. Louis Ruthenburg, chairman of the board of Servel, Inc., will be installed as president, replacing Frederic O. Hess, president of Selas Corp. of America. A. B. Ritzenthaler, vice president of the Tappan Stove Co., will move up to first vice president and J. F. Donnelly, marketing director of A. O. Smith Corp., will become second vice president. Lyle C. Harvey, president of Affiliated Gas Equipment, Inc., will retain his position as treasurer while H. Leigh Whitelaw will remain as managing director and secretary.

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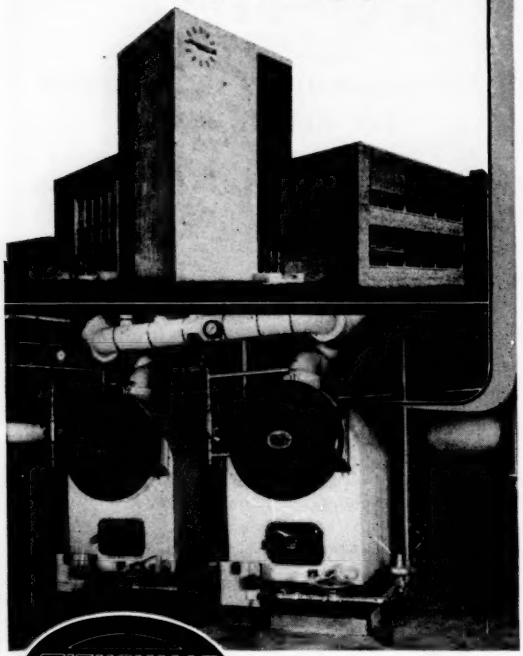

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CYCLONE FURNACE TESTS

seek better fuel use by burning coal and other fuels in whirling flame.

Tests expected to throw more light on the problem of getting better efficiencies from low grade fuels are being conducted in a new installation at the Barberton, Ohio, plant of The Babcock & Wilcox Co. The tests are being made by burning the fuels in a cyclone furnace under commercial conditions.

• **NEW DEVICE.**—A cyclone furnace is a new device being manufactured by the company which burns crushed coal and other fuels in a whirling tornado of flames within a cylindrical unit producing high temperatures. Fuel and pre-heated air are introduced cyclonically at one end of the unit and high temperature gaseous products of combustion are emitted at the other end. Action of the furnace coats the walls of the cyclone with a molten layer of ash into which the fuel is thrown by centrifugal force. Combustible materials burn, giving up heat, and non-combustible residue melts and drops into a pit as slag, greatly reducing ash discharge from smoke stacks. A number of these units are in service throughout the nation at the present time.

The cyclone furnace in which the tests here are being conducted is a component part of one of the company's new boilers which will be used in regular service at the plant giving operational data under true commercial conditions.

COAL SHEAR

tested in move to boost anthracite output with mechanized mining.

A compressed-air-operated German machine, known as the Korfmann Universal Shearing Machine, Model SK 20, promises to be useful for mechanized mining of steeply pitched anthracite beds.

According to preliminary tests of the Bureau of Mines, the Korfmann machine would aid in increasing the rate of gangway driving.

• **TESTS MADE.**—The shearing machine weighs about a ton and a half, is track mounted, and is of the conventional cutter bar and chain type. Its rotating cutting mechanism allows it to cut in any direction.

Tests were conducted of the machine's power characteristics, maneuverability and effectiveness under varied conditions of anthracite mining, the Bureau of Mines report states.

Mine operators are cooperating with the Bureau in the effort to develop a method of mechanical underground mining adapted to the Pennsylvania anthracite region.

• **MODIFICATIONS.**—The released report on the machine carries a suggestion by Bureau engineers for modifications of design to increase its maneuverability. Comparison of this machine with the smaller, lower-powered Eickhoff shearing machine, shows that the latter is more maneuverable but will make only vertical cuts.

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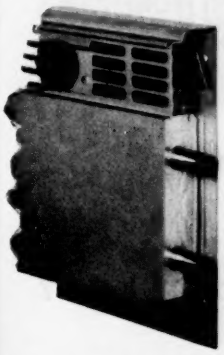

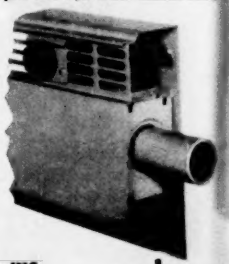

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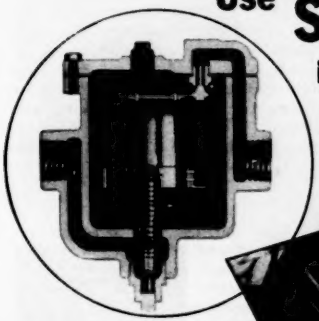

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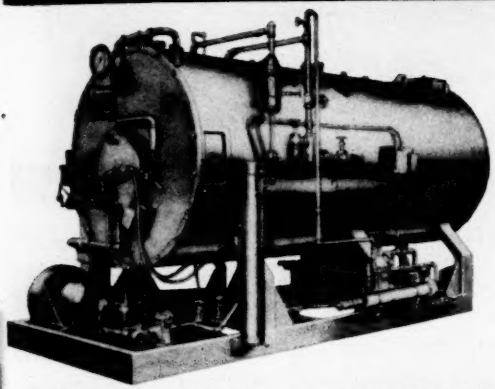

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• B. B. Magee has been appointed Director of U. S. Sales for the Iron Fireman Manufacturing Co., Cleveland, Ohio. Mr. Magee has been sales manager of the Northwest Division for Iron Fireman since 1929 with headquarters in Minneapolis.

• Edward T. Murphy, 71, senior vice president of Carrier Corp., and a member of its Board of Directors since 1930, passed away on August 21 in San Francisco after a brief illness. He was one of the seven founders of Carrier Engineering Corp. in 1915, predecessor of the present company. Years before this, as a young employee of Buffalo Forge Co., he worked with the late Dr. Willis H. Carrier.

• Photoelectric particle-size meters developed by the Naval Research Laboratory, ONR, permit more precise measurements than previously possible. One meter is designed for routine measurements, such as monitoring particle size of a test aerosol; the other is used as a laboratory instrument for research on light-scattering properties of aerosols. Measurement range is from two-tenths to four-tenths micron, with accuracy to four ten-thousandths micron.

Getting Personal

Robert H. Avery (*Recirculation of Cleaned Air from Cast Iron Machining*, page 69) received his Bachelor's degree in chemistry from Holy Cross College, Worcester, Mass., in 1941, and an M.S. in chemistry from Northeastern University, Boston, Mass., in 1943. He then went to work for the State of Michigan as industrial hygiene engineer. He was transferred to the U. S. Public Health Service in May, 1944, and assigned to St. Louis County Health Department and then to Kansas State Board of Health as industrial hygiene engineer. He joined American Air Filter Company in July, 1946, and worked in the Dust Control Division as application engineer and later district manager until September of this year when he joined L. O. R. Clark, Inc., in Hartford, Conn.

W. D. McCully

W. D. McCully (*Constructing Steam Service to Henry Ford Hospital*, page 80) was graduated with the degree of Bachelor of Science in civil engineering from Michigan State College in 1929. He joined Detroit Edison Company and engaged in design and construction of steam lines and other facilities during expansion of the company's district heating system. During World War II he served with the Corps of Engineers in the Middle East and was discharged at the end of the war with a commission as Major. After the war, he returned to Detroit Edison and is at present a steam engineer and supervisor specializing in construction of underground steam distribution lines. Design and construction of the 16-inch pipeline extension serving the Ford Hospital was one of his recent projects.

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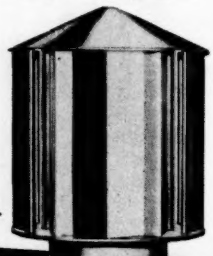

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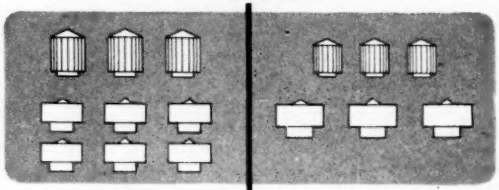

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ABSTRACTS AND REVIEWS

Publications abstracted in this department should be ordered direct from publisher.

DESIGN OF INSULATED BUILDINGS

The presentation of useful technical information in a non-technical manner was achieved by T. S. Rogers in his book Design of Insulated Buildings for Various Climates. In the preparation of this book he was assisted by Dr. Paul A. Siple, climatologist and military geographer, Department of the Army, General Staff; Prof. Elmer Queer, consultant on heat transmission and vapor control, State College, Pa.; Howard T. Fisher, consulting architect and industrial designer; and John Hancock Callender, consulting architect, Southwest Research Institute.

The book is divided into two parts—the first covering principles and the second practice. While the first part covers such basic information as climate, heat control, vapor control and ventilation, the second part is a working manual with recommended standards of good practice in heat control, vapor control and structural ventilation. Time-saver design tables give all the thermal data necessary for the functional design of all types of buildings. In all, there are 29 tables to help solve design problems.

The author, who has succeeded in making his subject most interesting, is director of technical publications for Owens-Corning Fiberglas Corp., and has devoted 30 years to the interpretation of technical facts to practical people.

Design of Insulated Buildings for Various Climates, by T. S. Rogers. Cloth bound, 9 x 12 inches, 119 pages. Published by Architectural Record, 119 W. 40th St., New York 18, N. Y. Price, $5.50.

HYDRAULIC TRANSPORTATION OF COAL—Report of Investigations No. 4799 on Survey on the Hydraulic Transportation of Coal contains estimates made by the Bureau of Mines on transporting coal with water in pipelines. The first American patent for such a method was issued in 1895 and a later one in 1905. This subject has been one of recurring interest and a large Ohio coal company plans to build a full-scale demonstration pipeline through which will be pumped finely ground coal and water. The estimates given in the report were purposely made on the conservative side and include the major costs involved in the construction and operation of coal pipelines. Bureau of Mines, 4800 Forbes Street, Pittsburgh 13, Pa.

COKING COAL RESERVES OF WESTMORELAND COUNTY—The Bureau of Mines, at the request of the Munitions Board of the Department of Defense, is making a county-by-county survey of known reserves of coking coal. This Report of Investigations 4803 on Estimate of Known Recoverable Reserves of Coking Coal in Westmoreland County, Pa., is the fifth of a series of county reports of this type. Bureau of Mines, Publications Distribution Section, 4800 Forbes St., Pittsburgh 13, Pa.

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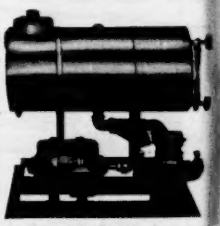
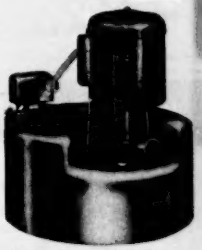


Type TM Turbine Pump



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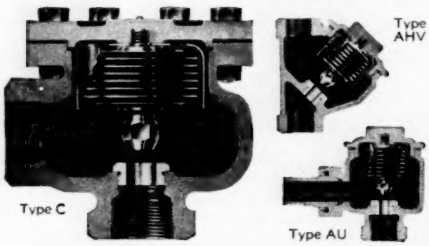

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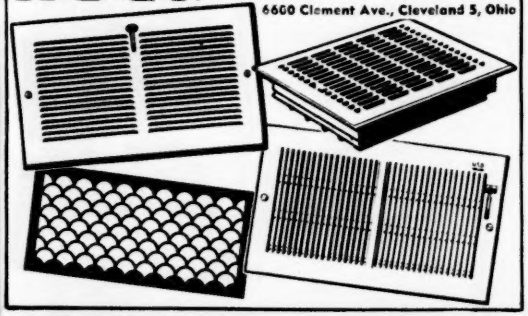

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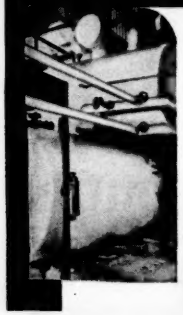

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WHAT WOULD YOU DO?

(Continued from page 105)

There are three general classes of spray booths. In Class 1, the worker stands outside the booth and the object being painted is inside the booth. Air motion from the workroom into the booth is relied upon to prevent mist and vapor from the spray gun from escaping into the workroom air. Most attempts at recirculation with this class of booth have been unsuccessful because introducing the returned air inside the booth itself cuts down the air motion in front of the booth thereby defeating the purpose of the booth. Returning the exhaust air to the general workroom is economically unsound because it would form part of the general workroom air breathed by employees other than spray gun operators and would therefore have to be cleaned of all solvent vapor as well as pigment.

In Class 2, both the painter and the object being painted are inside the booth. A booth of this class can be completely enclosed with all supply air entering through ducts; or it can be open at one end with all supply air entering through the open end from the workroom; or it may have any combination of room and duct supply with restricted opening from the room to the booth. The only criteria that must be met are that there be no backflow from the booth into the workroom, that there be unidirectional air flow of adequate velocity, uniform across the cross section of the working zone, and that the temperature and quality of the air at the working zone be uniform across the cross section and within acceptable standards. It is theoretically possible to meet these criteria in a booth that has part of its air supply recirculated.

Booth baffles and water walls do not clean air sufficiently to allow its direct recirculation. Therefore, the recirculated portion must be passed through air cleaning equipment additional to that in the booth itself prior to re-introduction to the booth. This cleaning equipment must remove all pigment from the recirculated air leaving only the solvent vapor as contaminant.

In most cases, the cost of building and maintaining adequate air cleaning equipment for this purpose will make the potential heating savings seem much less attractive. Another item of cost likely to discourage the use of recirculation is that of control equipment to allow recirculation only when there is a strain on the heating plant and to prevent it during warm weather when there is no need for recirculation to conserve heat.

Where the recirculated air contains a predetermined amount of solvent vapor, the solvent vapor concentration of the mixture of recirculated air and fresh makeup air can be calculated for various percentages of recirculated air, allowing a factor of safety for less than perfect mixing of the two before reaching the working zone. If the solvent contains extremely toxic liquids such as benzol, carbon tetrachloride, or other solvents with maximum allowable concentrations below 200 ppm, it would be very bad judgment to recirculate air containing its vapor even if well diluted. However, if the solvent is composed only of liquids such as toluol, acetone or petroleum naphtha having maximum

allowable concentrations for 8-hour per day exposure of 200 ppm and above, and if a high dilution factor is used so that the calculated solvent vapor concentrations of the mixture is less than about 1/10 of the maximum allowable concentration, the use of recirculated air would not be inherently unsafe particularly since (1) with the necessary outdoor temperature responsive recirculation control, recirculation would occur only during a relatively small percentage of total working hours, and (2) as an additional safeguard, the painters would be supplied with spray painting respirators.

In one large booth of this type having a capacity of 150,000 cfm, the following recirculation schedule was employed for the automatic controls:

Outside Temperature, F	Exhaust, Per Cent	Recirculate, Per Cent
50	100	None
47	75	25
37.5	50	50
32	40	60
25	32	68
15 and below	25	75

At maximum per cent recirculation (75%), the calculated toluol concentration of air supplied to the spraying zone is 9.75 ppm.

Class 3 is the automatic booth in which no operator works. Recirculation is limited only by safety from explosion (i.e., maintain a factor of safety of at least 5 with respect to the lower explosive limit of the solvent vapor) and the requirement that there be no outward flow of air, mist or vapor from the booth to the workroom.

The alternate to recirculation is to use a heating system for booth supply air, separate from the heating system for the factory building as a whole. When this air is heated by gas either directly or indirectly, no strain is placed on the steam or hot water heating plant. Such separately heated air can be carried by duct to the room area where the first class of booths are used or directly into booths of Class 2. For Class 3 booths minimum temperature requirements are set by the characteristics of the finish rather than the needs of an operator. They can, therefore, sometimes be supplied with unheated outdoor air for a large percentage of the time when the factory air needs heating for employee comfort.

Arthur C. Stern
Chief, Engineering Unit,
Division of Industrial Hygiene
and Safety Standards,
New York State Department of Labor
New York, N. Y.

COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

ASA MEETING—33rd annual meeting and national standardization conference of the American Standards Association, at the Waldorf-Astoria Hotel, New York, N. Y. Secretary of the Association, 70 East 45th St., New York, N. Y. ..... **OCTOBER 22-24, 1951.**

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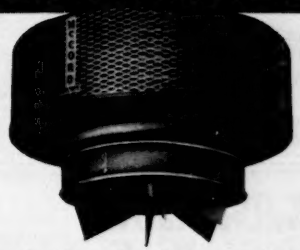

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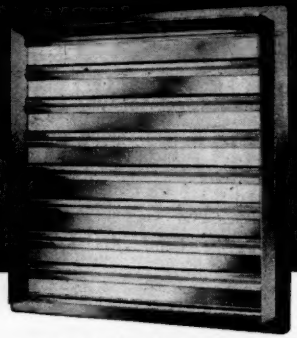

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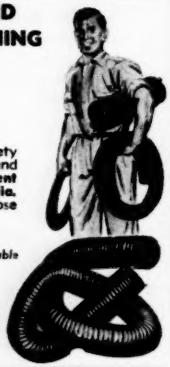

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PLUMBING AND HEATING MEETING—Annual meeting of the Plumbing and Heating Industries Bureau, at the Palmer House, Chicago, Ill. Norman J. Radder, secretary, 35 East Wacker Drive, Chicago 1, Ill. ..... **OCTOBER 25, 1951.**

PUBLIC HEALTH MEETING — 79th annual meeting of the American Public Health Association, at Civic Auditorium, San Francisco, Calif. Willimina Rayne Walsh, associate secretary of the Association, 1790 Broadway, New York 19, N. Y. ..... **OCTOBER 29—NOVEMBER 2, 1951.**

REFRIGERATION SHOW—7th All-Industry Refrigeration and Air Conditioning Exposition, at Navy Pier, Chicago, Ill. Show director, REMA 1346 Connecticut Ave., N.W., Washington, D. C. ..... **NOVEMBER 5-8, 1951.**

STEEL BOILER MEETING—National meeting of the Steel Boiler Institute, at the Shoreham Hotel, Washington, D. C. R. A. Locke, secretary, Land Title Building, Philadelphia 10, Pa. ..... **NOVEMBER 8-9, 1951.**

ASME MEETING—Annual meeting of the American Society of Mechanical Engineers, at Chalfonte-Haddon Hall, Atlantic City, N. J. C. E. Davies, secretary of the Society, 29 West 39th St., New York, N. Y. ..... **NOVEMBER 25-30, 1951.**

CHEMICAL EXPOSITION—23rd Exposition of Chemical Industries, at Grand Central Palace, New York. Charles F. Roth, manager of the International Exposition Company, Grand Central Palace, New York 17, N. Y. ..... **NOVEMBER 26—DECEMBER 1, 1951.**

CHEMICAL ENGINEERS MEETING—Annual meeting of the American Institute of Chemical Engineers, at Chalfonte-Haddon Hall, Atlantic City, N. J. Secretary of the Institute, 29 West 39th St., New York 18, N. Y. ..... **DECEMBER 2-5, 1951.**

ASRE MEETING—Annual meeting of the American Society of Refrigerating Engineers, at the Hotel Roosevelt, New Orleans, La. M. C. Turpin, secretary of the Society, 40 W. 40th St., New York, N. Y. ..... **DECEMBER 2-5, 1951.**

HEATING WHOLESALERS' MEETING—Annual meeting of the National Heating Wholesalers' Association, at the Hotel Statler, Cleveland, Ohio. E. L. Wyman, executive secretary, 609 Commerce Building, Cleveland. ..... **DECEMBER 3-4, 1951.**

WARM AIR CONVENTION—38th annual convention of the National Warm Air Heating and Air Conditioning Association, at Hotel Cleveland, Cleveland, Ohio. George Boeddener, 145 Public Square, Cleveland. ..... **DECEMBER 5-6, 1951.**

PLANT MAINTENANCE SHOW AND CONFERENCE — 3rd plant maintenance show and conference, at Convention Hall, Philadelphia, Pa. Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y. ..... **JANUARY 14-17, 1952.**

AUTOMOTIVE ENGINEERS MEETING — Annual meeting of the Society of Automotive Engineers, Inc., at the Hotel Book-Cadillac, Detroit, Mich. John A. C. Warner, secretary of the Society, 29 West 39th St., New York 18, N. Y. ..... **JANUARY 14-18, 1952.**

ELECTRIC ENGINEERING MEETING—Winter general meeting of the American Institute of Electrical Engineers, at the Hotel Statler, New York, N. Y. Secretary of the Institute, 33 West 39th St., New York 18, N. Y. ..... **JANUARY 21-25, 1952.**

ASHVE MEETING—58th annual meeting of the American Society of Heating and Ventilating Engineers, in St. Louis, Mo. A. V. Hutchinson, secretary of the Society, 51 Madison Ave., New York 10, N. Y. ..... **JANUARY 28-30, 1952.**

OIL HEAT EXPOSITION—National Oil Heat Exposition, at Commercial Museum, Philadelphia, Pa., in conjunction with the 29th annual convention of Oil-Heat Institute of America, at the Benjamin Franklin Hotel. R. H. L. Becker, secretary of the Institute, 6 East 39th St., New York 16, N. Y. ..... **APRIL 14-18, 1952.**

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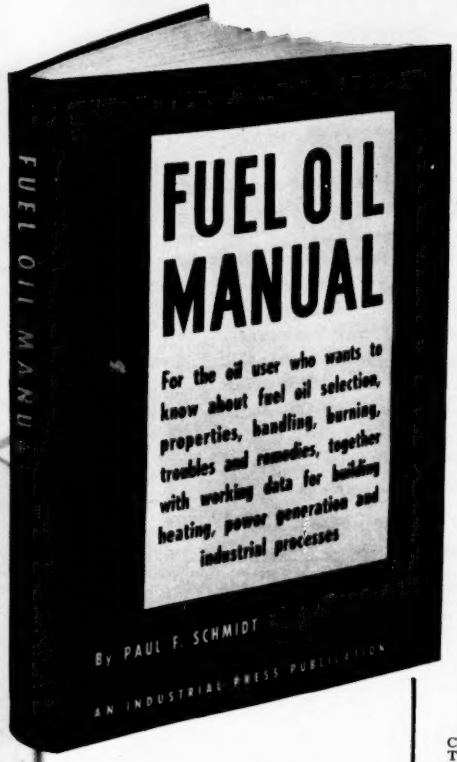
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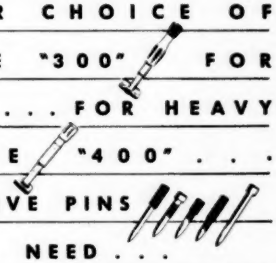

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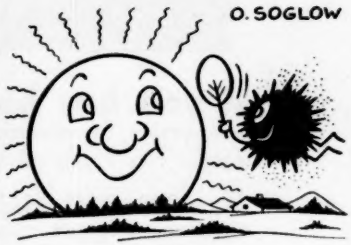

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The Filter Engineers

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SILENCERS
SPARK ARRESTERS
LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS

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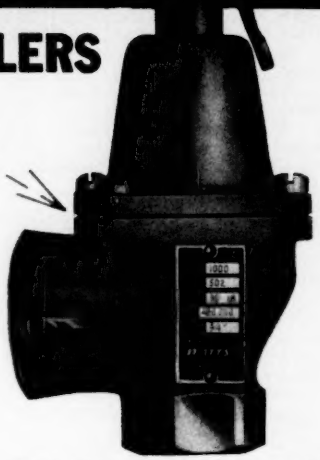
*Advertisement appeared in preceding issue.

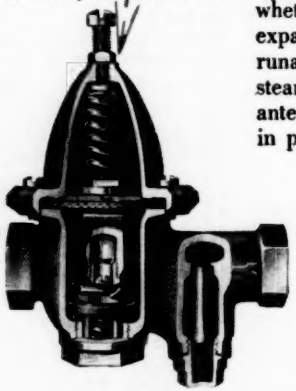
FOR HOT WATER HEATING BOILERS

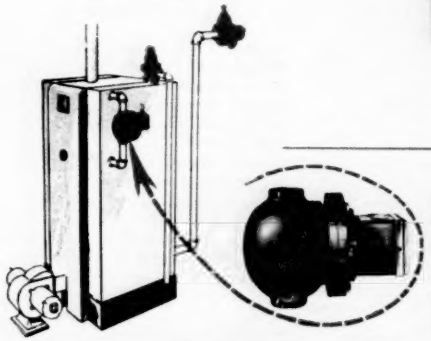
WATTS DOUBLE PROTECTION: The prevention of excessive pressures and the assurance of a supply of water at all times are the first considerations to safe hot water heating boiler operation. Over the years, double protection (dual control) has been accepted as the logical boiler protection by the plumbing and heating industry. A dependable, properly rated, boiler safety relief valve to relieve excessive pressure conditions within a system should be specified for every job. Any loss of water due to thermal expansion relief, leakage, or prolonged steam discharge caused by runaway firing, should be replaced without delay. Therefore, a reliable, automatic feed water regulator should be included as an integral part of every system. Only then can adequate protection be assured. Watts No. 74 ASME rated boiler safety relief valve and No. 135HW feed water regulator make an unbeatable combination for basic hot water heating boiler safety and control.



THE NO. 74 safeguards against any pressure rise in the system, whether it be simple thermal expansion, or steam caused by runaway firing. Its high BTU steam discharge capacity guarantees against any further rise in pressure above 30 lbs.

THE NO. 135HW automatically responds to any need for make-up water, if the pressure drops below 12-15 lbs. This assures an adequate supply of water and maintains minimum pressure requirements in the system at all times.





P. S. If, for any reason, the water supply to the boiler should fail and a dangerous low water condition should occur in the boiler, a Watts No. 50A low water cut-off will prevent damage to the boiler in this *extreme* emergency. The No. 50A low water cut-off was designed to offer this additional protection if it is specified.

WATTS Regulator Company LAWRENCE, MASSACHUSETTS

Plumbing and Heating...Safety Valves and Controls

HEAT LOSSES FOR VARIOUS U-VALUES AND AREAS

(Continued from previous data sheet)

AREA IN SQ FT	VALUE OF U IN BTU PER HR PER DEG TEMP DIFFERENCE PER SQ FT																					
	.28	.30	.32	.34	.36	.38	.40	.42	.44	.46	.48	.50	.52	.54	.56	.58	.60	.70	.80	1.00	1.06	1.13	1.30
	BTU HEAT LOSS AT 0-70 DEG TEMPERATURE DIFFERENCE																					
1	20	21	22	24	25	27	28	29	31	32	34	35	36	38	39	41	42	49	56	70	74	80	105
2	41	42	45	48	50	32	56	59	62	64	67	70	73	76	78	81	84	98	112	140	148	158	210
3	61	63	67	71	76	80	84	88	92	97	101	105	109	113	118	122	126	147	168	210	223	237	315
4	81	84	90	95	101	106	112	118	123	129	134	140	146	151	157	162	168	196	224	280	297	316	420
5	102	105	112	119	126	133	140	147	154	161	168	175	182	190	196	203	210	245	280	350	371	396	525
6	122	126	134	143	151	160	168	176	185	193	202	210	218	227	235	244	252	294	336	420	445	475	630
7	142	147	157	167	176	186	196	206	216	225	235	245	255	265	274	284	294	343	392	490	518	554	735
8	162	168	180	190	202	213	224	235	246	257	269	280	291	302	312	325	336	392	448	560	594	633	840
9	183	189	202	214	227	239	252	265	277	290	302	315	328	340	353	365	378	441	504	630	668	712	945
10	203	210	224	238	252	266	280	294	308	322	336	350	364	378	392	406	420	490	560	700	742	791	1050
11	223	231	246	262	277	293	308	323	339	354	370	385	400	416	431	447	462	539	616	770	816	870	1155
12	244	252	269	286	302	319	336	353	370	386	403	420	437	454	470	487	504	588	672	840	890	949	1260
13	264	273	291	309	328	346	364	382	400	419	437	455	473	491	510	528	546	637	728	910	965	1028	1365
14	284	294	314	333	353	372	392	412	431	451	470	490	510	529	548	568	588	686	784	980	1039	1107	1470
15	305	315	336	357	378	399	420	441	462	483	504	525	546	567	589	609	630	735	840	1050	1113	1187	1575
16	325	336	358	381	403	426	448	470	493	515	538	560	582	605	627	650	672	784	896	1120	1187	1266	1680
17	345	357	381	405	428	452	476	500	524	547	571	595	619	643	666	690	714	833	952	1190	1261	1344	1785
18	365	378	403	428	454	479	504	529	554	580	605	630	655	680	706	731	756	882	1008	1260	1336	1424	1890
19	386	399	426	452	479	505	532	559	585	612	638	665	692	718	745	771	798	931	1064	1330	1410	1503	1995
20	406	420	448	476	504	532	560	588	616	644	672	700	728	756	784	812	840	980	1120	1400	1484	1582	2100
21	426	441	470	500	529	558	588	617	647	676	706	735	764	794	823	853	882	1029	1176	1470	1559	1661	2205
22	447	462	493	525	554	585	616	647	678	708	739	770	801	832	862	893	924	1078	1232	1540	1632	1740	2310
23	467	483	515	548	580	612	644	676	708	741	773	805	835	869	902	934	966	1127	1288	1610	1707	1819	2415
24	487	504	538	572	605	638	672	706	738	771	806	840	874	907	941	974	1008	1176	1344	1680	1781	1898	2520
25	508	525	560	596	630	665	700	735	770	805	840	875	910	945	980	1015	1050	1225	1400	1750	1855	1978	2625
26	528	546	582	620	655	692	728	764	801	837	874	910	946	983	1019	1056	1092	1274	1456	1820	1929	2057	2730
27	548	567	605	644	680	718	756	798	832	868	907	945	983	1021	1058	1096	1134	1323	1512	1890	2003	2136	2835
28	568	588	627	667	706	745	784	823	862	902	941	980	1019	1058	1098	1137	1176	1372	1568	1960	2078	2215	2940
29	589	609	650	691	731	771	812	853	893	934	974	1015	1056	1096	1137	1177	1218	1421	1624	2030	2152	2294	3045
30	609	630	672	715	756	798	840	882	924	966	1008	1050	1092	1134	1176	1218	1260	1470	1680	2100	2226	2373	3150
31	629	651	694	739	781	825	868	911	955	998	1042	1085	1128	1172	1215	1259	1302	1519	1736	2170	2300	2452	3255
32	650	672	717	763	806	851	896	941	986	1030	1075	1120	1165	1210	1254	1299	1344	1568	1792	2240	2374	2531	3360
33	670	693	739	786	832	878	924	970	1016	1063	1109	1155	1201	1247	1294	1340	1386	1617	1848	2310	2449	2610	3465
34	690	714	762	810	857	904	952	1000	1047	1095	1142	1190	1238	1285	1333	1380	1428	1666	1904	2380	2523	2689	3570
35	711	735	784	834	882	931	980	1029	1078	1127	1176	1225	1274	1323	1372	1421	1470	1715	1960	2450	2597	2769	3675
36	731	756	806	858	907	958	1008	1058	1108	1158	1210	1260	1310	1361	1411	1462	1512	1764	2016	2520	2671	2848	3780
37	751	777	829	882	932	984	1036	1088	1140	1191	1243	1295	1347	1399	1450	1502	1554	1813	2072	2590	2745	2927	3885
38	771	798	851	905	958	1011	1064	1117	1170	1224	1277	1330	1383	1436	1490	1543	1596	1862	2128	2660	2820	3006	3990
39	792	819	874	929	983	1037	1092	1147	1201	1256	1310	1365	1420	1474	1528	1583	1638	1911	2184	2730	2894	3085	4095
40	812	840	896	953	1008	1064	1120	1176	1232	1288	1344	1400	1456	1512	1568	1624	1680	1960	2240	2800	2968	3164	4200
41	832	861	918	977	1033	1091	1148	1205	1263	1320	1378	1435	1492	1550	1607	1665	1722	2009	2296	2870	3042	3243	4305
42	853	882	941	1001	1058	1117	1176	1235	1294	1352	1411	1470	1529	1588	1646	1705	1764	2058	2352	2940	3116	3322	4410
43	873	903	963	1024	1084	1144	1204	1264	1324	1385	1445	1505	1565	1625	1686	1746	1806	2107	2408	3010	3191	3401	4515
44	893	924	986	1048	1108	1170	1232	1294	1355	1417	1478	1540	1602	1663	1725	1786	1848	2156	2464	3080	3265	3480	4620
45	914	945	1008	1072	1134	1197	1260	1323	1386	1449	1512	1575	1638	1701	1764	1827	1890	2205	2520	3150	3339	3560	4725
46	934	966	1030	1096	1159	1224	1288	1352	1417	1481	1546	1610	1674	1739	1803	1868	1932	2254	2576	3220	3413	3639	4830
47	954	987	1053	1120	1184	1250	1316	1382	1448	1513	1579	1645	1711	1777	1842	1908	1974	2303	2632	3290	3487	3718	4935
48	974	1008	1075	1143	1210	1277	1344	1411	1478	1546	1613	1680	1747	1814	1882	1949	2016	2352	2688	3360	3562	3797	5040
49	995	1029	1098	1167	1235	1303	1372	1441	1509	1578	1646	1715	1784	1852	1921	1989	2058	2401	2744	3430	3636	3876	5145
50	1015	1050	1120	1191	1260	1330	1400	1470	1540	1610	1680	1750	1820	1890	1960	2030	2100	2450	2800	3500	3710	3955	5250
51	1035	1071	1142	1215	1285	1357	1428	1499	1571	1642	1714	1785	1856	1928	1999	2071	2142	2499	2856	3570	3784	4034	5355
52	1056	1092	1165	1239	1310	1383	1456	1529	1602	1674	1747	1820	1893	1966	2038	2111	2184	2548	2912	3640	3858	4113	5460
53	1076	1113	1187	1262	1336	1410	1484	1558	1632	1707	1781	1855	1929	2003	2078	2152	2226	2597	2968	3710	3933	4192	5565
54	1096	1134	1210	1286	1361	1436	1512	1588	1663	1739	1814	1890	1966	2041	2117	2192	2268	2646	3024	3780	4007	4271	5670
55	1117	1155	1232	1310	1386	1463	1540	1617	1694	1771	1848	1925	2002	2079	2156	2233	2310	2695	3080	3850	4081	4351	5775

HEAT LOSSES FOR VARIOUS U-VALUES AND AREAS

AREA IN SQ FT	VALUE OF U IN BTU PER HR PER DEG TEMP DIFFERENCE PER SQ FT																				
	.29	.30	.32	.34	.36	.38	.40	.42	.44	.46	.48	.50	.52	.54	.56	.58	.60	.70	.80	1.00	1.06	1.13	1.50
	BTU HEAT LOSS AT 0-70 DEG TEMPERATURE DIFFERENCE																				
56	1137	1176	1254	1334	1411	1490	1568	1646	1725	1803	1882	1960	2038	2117	2195	2274	2352	2594	3136	3920	4155	4430	5880
57	1157	1197	1277	1358	1436	1516	1596	1676	1756	1835	1915	1995	2075	2155	2234	2314	2394	2643	3192	3990	4229	4509	5985
58	1177	1218	1299	1381	1462	1543	1624	1705	1786	1868	1949	2030	2111	2192	2274	2355	2436	2692	3248	4060	4304	4588	6090
59	1198	1239	1322	1409	1487	1569	1652	1735	1817	1900	1982	2065	2148	2230	2313	2395	2478	2741	3304	4130	4378	4667	6195
60	1218	1260	1348	1428	1512	1596	1680	1764	1848	1932	2016	2100	2184	2268	2352	2436	2520	2940	3360	4200	4452	4746	6300
61	1238	1281	1366	1453	1537	1623	1708	1793	1878	1964	2050	2135	2220	2306	2391	2477	2562	2989	3416	4270	4526	4825	6405
62	1259	1302	1389	1477	1562	1649	1736	1823	1910	1996	2083	2170	2257	2344	2430	2517	2604	3038	3472	4340	4600	4904	6510
63	1279	1323	1411	1500	1588	1676	1764	1852	1940	2029	2117	2205	2293	2381	2470	2558	2646	3087	3528	4410	4675	4983	6615
64	1299	1344	1434	1524	1613	1702	1792	1882	1971	2061	2150	2240	2330	2419	2509	2598	2688	3136	3584	4480	4749	5062	6720
65	1320	1365	1456	1548	1638	1729	1820	1911	2002	2093	2184	2275	2366	2457	2548	2639	2730	3185	3640	4550	4823	5142	6825
66	1340	1386	1478	1572	1663	1756	1848	1940	2033	2125	2218	2310	2402	2495	2587	2680	2772	3234	3696	4620	4897	5221	6930
67	1360	1407	1501	1596	1678	1782	1876	1970	2064	2157	2251	2345	2438	2533	2626	2720	2814	3283	3752	4690	4971	5300	7035
68	1380	1428	1523	1619	1704	1809	1904	1999	2094	2190	2285	2380	2475	2570	2666	2761	2856	3332	3808	4760	5046	5379	7140
69	1401	1449	1546	1643	1729	1835	1932	2029	2125	2222	2318	2415	2512	2608	2705	2801	2898	3381	3864	4830	5120	5458	7245
70	1421	1470	1568	1667	1764	1862	1960	2058	2156	2254	2352	2450	2548	2646	2744	2842	2940	3430	3920	4900	5194	5537	7350
71	1441	1491	1590	1691	1779	1889	1988	2087	2187	2286	2386	2485	2584	2684	2783	2883	2982	3479	3976	4970	5268	5616	7455
72	1462	1512	1613	1715	1804	1915	2016	2117	2218	2319	2419	2520	2621	2722	2822	2923	3024	3528	4032	5040	5342	5695	7560
73	1482	1533	1635	1738	1830	1942	2044	2146	2248	2351	2453	2555	2657	2759	2862	2964	3066	3577	4088	5110	5417	5774	7665
74	1502	1554	1658	1762	1855	1968	2072	2176	2279	2383	2486	2590	2694	2797	2901	3004	3108	3626	4144	5180	5491	5853	7770
75	1523	1575	1680	1786	1880	1995	2100	2205	2310	2415	2520	2625	2730	2835	2940	3045	3150	3675	4200	5250	5565	5933	7875
76	1543	1596	1702	1810	1905	2022	2128	2234	2341	2447	2554	2660	2766	2873	2979	3086	3192	3724	4256	5320	5639	6012	7980
77	1563	1617	1725	1834	1930	2048	2156	2264	2372	2480	2587	2695	2803	2911	3018	3126	3234	3773	4312	5390	5719	6091	8085
78	1583	1638	1747	1857	1956	2075	2184	2293	2402	2512	2621	2730	2839	2948	3058	3167	3276	3822	4368	5460	5788	6170	8190
79	1604	1659	1770	1881	1981	2101	2212	2323	2433	2544	2654	2765	2876	2986	3097	3207	3318	3871	4424	5530	5862	6249	8295
80	1624	1680	1792	1905	2016	2128	2240	2352	2464	2576	2688	2800	2912	3024	3136	3248	3360	3920	4480	5600	5936	6328	8400
81	1644	1701	1814	1929	2041	2155	2268	2381	2495	2608	2722	2835	2948	3062	3175	3289	3402	3969	4536	5670	6010	6407	8505
82	1665	1722	1837	1953	2066	2181	2296	2411	2526	2641	2755	2870	2985	3100	3214	3329	3444	4018	4592	5740	6084	6486	8610
83	1685	1743	1859	1976	2092	2208	2324	2440	2556	2673	2788	2905	3021	3137	3254	3370	3486	4067	4648	5810	6158	6565	8715
84	1705	1764	1882	2000	2117	2234	2352	2470	2587	2705	2822	2940	3058	3175	3293	3410	3528	4116	4704	5880	6233	6644	8820
85	1726	1785	1904	2024	2142	2261	2380	2499	2618	2737	2856	2975	3094	3213	3332	3451	3570	4165	4760	5950	6307	6724	8925
86	1746	1806	1926	2048	2167	2288	2408	2528	2649	2769	2890	3010	3130	3251	3371	3492	3612	4214	4816	6020	6381	6803	9030
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94	1908	1984	2106	2238	2369	2500	2632	2764	2895	3027	3158	3290	3422	3553	3685	3816	3948	4606	5264	6580	6975	7435	9870
95	1929	2005	2128	2262	2394	2527	2660	2793	2926	3059	3192	3325	3458	3591	3724	3857	3990	4655	5320	6650	7049	7515	9975
96	1949	2026	2150	2286	2420	2554	2688	2822	2957	3091	3226	3360	3494	3629	3763	3898	4032	4704	5376	6720	7123	7594	10080
97	1969	2047	2173	2310	2444	2580	2716	2852	2988	3124	3258	3395	3531	3667	3802	3938	4074	4753	5432	6790	7197	7673	10185
98	1989	2068	2195	2333	2470	2607	2744	2881	3018	3156	3293	3430	3567	3704	3842	3979	4116	4802	5488	6860	7272	7752	10290
99	2010	2089	2218	2357	2495	2633	2772	2911	3049	3188	3326	3465	3604	3742	3881	4019	4158	4851	5544	6930	7346	7831	10395
100	2030	2100	2240	2380	2520	2660	2800	2940	3080	3220	3360	3500	3640	3780	3920	4060	4200	4900	5600	7000	7420	7910	10500
200	4060	4200	4480	4760	5040	5320	5600	5880	6160	6440	6720	7000	7280	7560	7840	8120	8400	9800	11200	14000	14840	15820	21000
300	6090	6300	6720	7140	7560	7980	8400	8820	9240	9660	10080	10500	10920	11340	11760	12180	12600	14700	16800	21000	22260	23730	31500
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500	10150	10500	11200	11900	12600	13300	14000	14700	15400	16100	16800	17500	18200	18900	19600	20300	21000	24500	28000	35000	37100	39550	52500
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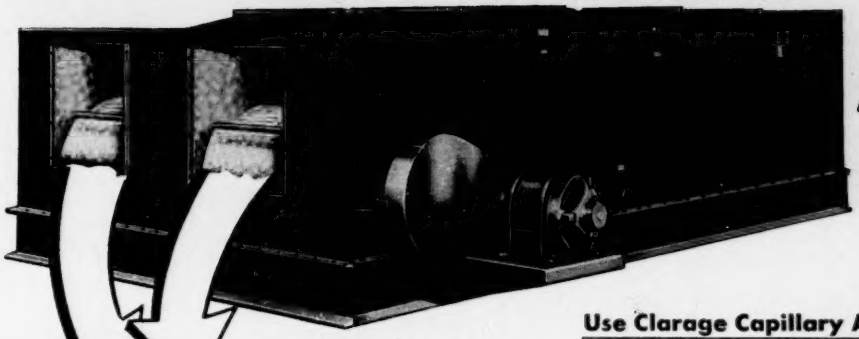
700	14210	14700	15580	16660	17640	18620	19600	20580	21560	22540	23520	24500	25580	26460	27440	28420	29400	34300	39200	49000	51940	55370	73500
800	16240	16800	17820	19040	20160	21280	22400	23520	24640	25760	26880	28000	29120	30240	31360	32480	33600	39200	44800	56000	59360	63280	84000
900	18270	18900	20060	21420	22680	23940	25200	26460	27720	28980	30240	31500	32760	34020	35280	36540	37800	44100	50400	63000	66780	71190	94500
1000	20300	21000	22400	23800	25200	26600	28000	29400	30800	32200	33600	35000	36400	37800	39200	40600	42000	49000	56000	70000	74200	79100	105000

WHEN YOUR PLANT AIR GOES IN HERE



Illustrated is a No. 34H3 Capillary Unit Conditioner with cooling and heating coils, providing complete air conditioning in one assembly.

It Comes Out Here
CLEAN and COOLED
HUMIDIFIED or DEHUMIDIFIED

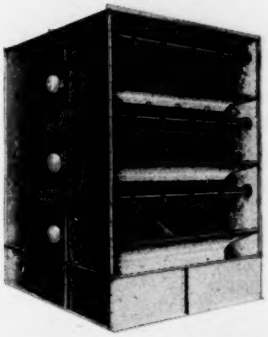
Use Clarage Capillary Air Conditioning Units where Accurate Control of Temperature and Humidity is Important — and where Maximum Air Cleanliness is Vital to Production, Uniform Quality of Product, Health or Safety.

Clarage Capillary Air Conditioners are complete factory assembled units, including a Capillary cleaning section, pump, heating coils, fan, drive and motor. They are available in seven sizes — 1800 to 20,000 c.f.m. Horizontal units, as shown above, are built in both Class I (con-current) and Class II (counter-current) types. Vertical units in Class II arrangement only.

There are excellent reasons for considering this modern air conditioning equipment: (1) Inexpensive to install — no costly building alterations required; (2) Everything in one "package" — no parts to assemble on the job; (3) Proper coordination and performance of all parts assured by factory tests; (4) Low first cost and low operating costs—the result of shrewd, advanced engineering.

★ ★ ★

Write for our Bulletin 122. It gives complete information.

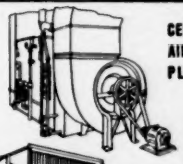


CAPILLARY AIR WASHERS

are available in a series of five height sizes, and in eleven widths — capacities from 4,400 to 132,000 c.f.m. They are built in Class I (con-current), Class II (counter-current) and Class III (con-current with coils) types. Bulletin 120 describes complete line of equipment.

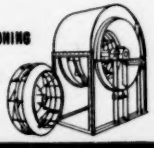
SOME OF OUR OTHER PRODUCTS

UNIT HEATERS



CENTRAL STATION AIR CONDITIONING PLANTS

AIR CONDITIONING AND VENTILATING FANS



AIR WASHERS

CLARAGE
FAN COMPANY
Kalamazoo, Michigan

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

". . . involving the world's largest and most intricate air conditioning project."

The Kalamazoo, Michigan, Plant of the Upjohn Company
The Austin Company, engineers and contractors, Chicago, Ill.

Over all, constantly on duty, are the super-human "brains" of another Johnson System of automatic temperature and humidity control. Like all Johnson Systems, the installation at Upjohn's was designed especially to solve the precise requirements of the industry which it serves. Such flexibility assures just the right results, regardless of the unusual applications which are encountered.

In the thoroughly modern Upjohn plant, the adaptability of Johnson equipment is demonstrated conclusively. There are 126 separate year-round air conditioning systems, with central heating and cooling coils, and at each the temperature of the air delivered to eight or more branch reheaters is controlled by Johnson instruments commanding Johnson valves and dampers. The characteristic Johnson "Master-Submaster" principle is employed in controlling Johnson valves on the reheaters. Submaster room thermostats for each area are reset, in accordance with outdoor temperature, to maintain exactly the required condition.

In addition to the comprehensive air conditioning equipment, 10 heating systems for smaller areas, 27 sets of convertors and 108 exhaust systems also are Johnson-controlled. In the truss spaces, 52 unit heaters are operated by Johnson thermostats and dampers, to prevent roof losses. Various special-purpose systems, for snow melting, office heating, hot water circulation in the warehouse, produce proper temperatures at the command of Johnson controllers which operate Johnson valves and dampers.

"Comfort" air, "process" air and critical humidity requirements present varied problems at the Upjohn plant. The proper solution of those problems is a part of the Johnson planned-for-the-purpose, installed-for-the-purpose policy. Whatever your problem may be, ask a Johnson engineer from a nearby branch office. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.

Johnson T-800-A
Capillary Thermostat

JOHNSON *Automatic Temperature and Air Conditioning* **CONTROL**

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885